ORAL CANCER and TUMORS of the JAWS

ORAL CANCER and TUMORS of the JAWS

GEORGE S SHARP M D F.A.C.S., F.A.C.R (Ther)

Professor of Pathology School of Dentistry
Assistant Clinical Professor of Surgery School of Medicine
University of Southern California
Director Pasadena Tumor Institute

WELDON K. BULLOCK M D M.Sc (Path.)

Associate Clinical Professor of Pathology School of Medicine
University of Southern California
Surgical Pathologist Los Angeles County Hospital

JOHN W HAZLET D D S

Lecturer Oral Tumor Pathology School of Dentistry
University of Southern California

The Blakiston Division

McGraw Hill Book Company Inc.
New York Toronto London 1956

ORAL CANCER AND TUMORS OF THE JAWS

Copyright © 1956 by the McGraw-Hill Book Company, Inc Printed in the United States of America All rights reserved This book, or parts thereof, may not be reproduced in any form without permission of the publishers

Library of Congress Catalog Card Number 55-12114

Foreword

While planned group efforts among physicians, dentists, and lay organizations—often labeled *cooperation*—are being given considerable emphasis in cancer control discussions, a fundamental aspect of the problem is often lost sight of, namely, what happens when a patient with cancer first consults a physician or dentist. No matter how well equipped and integrated the health organization (clinic, medical group, voluntary or government agency, etc.), the initial patient-doctor contact and subsequent relationship still remains the cornerstone upon which a cure or palliation of a given case will largely depend.

In acute nonneoplastic diseases, the need for relief of the immediate distress is so urgent as to actually force a diagnosis within a relatively short time. On the other hand, in highly lethal diseases such as cancer, the significance of early and vague symptoms may be missed by the first physician or dentist who is consulted. *The first patient-physician or patient-dentist contact, therefore, is of paramount importance.*

It may be stated without any hesitancy that oral cancer is more serious and more important to the patient than any other condition with which it might possibly be confused. Therefore, in any suspicious lesion of the mouth, both physician and dentist should consider cancer first and should rule out such a possibility before waiting "to see what happens" or before proceeding with treatment on the basis of a benign diagnosis. If the *possibility* of a malignant growth is considered at the beginning, few harmful errors in diagnosis will be made.

Two methods of treatment are effective—surgery and radiation—and the selection of the type of therapy should be based upon the best chance for a permanent cure. Oral cancer usually gives but one chance for complete eradication.

The concept that cancer is incurable is untenable. Such an erroneous belief, still widely prevalent, is at present based on prejudices of long standing together with a paucity of accurate facts about cancer available to laymen and professional groups.

Hayes Martin

PREFACE

The value of early diagnosis and prompt treatment of cancer is well known That the mortality from oral cancer might well be reduced as much as 50 per cent by early recognition of its symptoms has been dramatized in widely publicized cancer programs Both the physician and the dentist have need for a specific reference text to help them recognize these early signs which have been adequately described but not in a single volume with thorough illustration. Many excellent publications on the subject of cancer of the oral cavity are available but none of them are of the ready reference type and little emphasis is given to the physical appearance of various pathologic entities

The purpose of this work is to provide a manual for the recognition of oral cancer to illustrate with text and photograph the difference between benign and malignant tumors, and to help the general practitioner and dentist arrive at a differential diagnosis of a particular lesion, by inspection and palpation prior to confirmation by biopsy To provide a well rounded understanding of disease entities the pathologic interpretation is summarized, likewise, roentgenographic findings are considered in detail as these are the most important preliminary steps in diagnosis This work, however is intended not as a textbook or reference guide on the *management* of cancer but as a *syllabus* for the oral diagnostician. In this respect it should prove unique since it is designed as a visual aid in the diagnosis of neoplasms.

Approximately 5 per cent of all cancers originate within the mouth. Because a great discrepancy exists in the literature as to the incidence of such cancers and the sex ratio and age of patients the authors have used throughout the book statistics based on their own cases In this summary 604 cases were selected from the Pasadena Tumor Institute and 416 from the Los Angeles County Hospital (Table 1 p 1)

The statistical chances for survival in cancer have been increased generally in the last decade owing to improved methods of anesthesia and the introduction of antibiotics which have permitted more extensive surgical dissections Any further increase in the rate of cure of cancer within the foreseeable future depends mainly on early diagnosis and immediate treatment. This may be brought about through closer co-

operation among the dentist, clinician, pathologist, radiologist, and cancer surgeon

It is hoped that those observing oral and jaw lesions will find their interest stimulated by this book to the end that a greater number of patients with early symptoms will be guided toward accurate pathologic diagnosis and specific treatment A significant improvement in the so-called cure statistics for oral cancer may be anticipated

At the conclusion of each chapter an estimate of the prognosis is presented

Because of our restricted specialty in cancer and allied diseases, many of the benign tumors and cysts of the jaws are not treated by us, however, certain physicians, dentists, and hospitals have made it possible to completely illustrate this portion of the book We wish to express our sincere thanks to Paul H Hamilton, D D S , Los Angeles County Hospital, and Gordon M Fitzgerald, D D S , College of Dentistry, University of California, San Francisco, for valuable criticism and for contributing roentgenograms of certain cysts and tumors of the jaws

One of us, with the enthusiastic cooperation of Dean Robert W. McNulty, D D S , School of Dentistry, University of Southern California, organized an oral tumor consultative board in 1947 The following members of this board have contributed certain unusual jaw-tumor cases, for which we extend our sincere gratitude Drs Frank L Adams, Robert L Fowkes, Leo J Fogel, Marsh E Robinson Harry E Straub, and S James Vamvas

Other members of The Southern California Oral Surgical Society who have given generously of their time to this diagnostic board and have provided additional cases in illustration of jaw lesions are Drs Robert W Christensen, J Robert Feeney, Roland A Grubb, O Mark Jenkins, Kenneth E Kipp, Edward E Lyman, Lester V Lyon, George M Prince, John G Sundbye, John Svoboda, Emil Tholen, John B. Wilson, and C Maynard Woodward

We are indebted to the departments of radiology and photography of Los Angeles County Hospital and to the Department of Radiology, Children's Hospital, Los Angeles, for several of the cases of skeletal disease

We wish to extend our deep appreciation to Allen Sylvester, photographer, who processed most of the illustrations for this book

George S Sharp
Weldon K Bullock
John W Hazlet

Contents

Introduction to Parts One and Two

Lesions of the oral mucosa are as a rule readily accessible. Notwith standing the great importance of such factors as site (Table 1) size

Table 1 INCIDENCE OF SQUAMOUS CARCINOMA OF THE LIPS AND ORAL SURFACES

Location	*No cases*	*Sex*		*Average Age*
		Male	*Female*	
Lip	519	479	40	60 4
Tongue	206	161	45	53 3
Alveolus	128	87	41	61 4
Floor of mouth	68	53	15	56 4
Palate	51	46	5	62 2
Cheek	48	38	10	65 8
Total	1020	864	156	59 2

Of these consecutive cases, 604 were from the Pasadena Tumor Institute and 416 from the Los Angeles County Hospital.

structure and behavior of cancerous tissue nothing else at the present time is so important to the welfare of the patient as the interval between the *onset* and the *time of recognition* of the disease Initial recognition of the gross pathologic condition is equally as important as microscopic confirmation of the neoplastic process To this end special skill is required, which the inexperienced may acquire through instruction reading, and study of clinical material

Throughout the oral cavity the mucous membrane presents so many common characteristics that lesions no matter where they are located show a number of striking similarities Clinical appearance, progress of the disease, treatment, and prognosis differ however to such an extent in the various anatomic sites that it is necessary to subdivide this text into chapters on the following subjects lip tongue floor of the mouth, gingivae, cheek, hard and soft palate and nasal and *accessory sinuses*

Certain clinical criteria are extremely helpful in the differentiation

Table 2 ESSENTIAL CLINICAL CRITERIA FOR ORAL TUMORS

Sign	*Benign*	*Malignant*
History	Long	Short
Induration	Absent	Present
Ulceration	Rare	Frequent
Margin	Well defined	Irregular
Mobility	Freely movable	Fixed
Papillary outgrowth	Frequent	Infrequent
Regional adenopathy	Absent	Frequent

between benign and malignant tumors (Table 2) The *history* of the complaint is of considerable importance lesions of extended duration are more commonly benign, while tumors of recent, rapid development are more likely to be malignant

Pain does not usually constitute an early symptom of oral cancer, nor is it, except in rare cases, associated with a benign tumor *Inflammation* rarely exists with a benign tumor, while the majority of oral cancers have a greater or less degree of an inflammatory reaction in or around the growth

The patient's *apprehension* a vague feeling of "something" is often the first symptom Concurrent with this vague feeling is often a *minute thickening*, plaque, or nodule often too small to be detected visibly Occasionally a slight stiffness along the sides of the tongue is described, or the tip of the tongue may single out a little thickening or roughness on the buccal or palatine surfaces Valuable evidence may be obtained in the majority of oral lesions through digital palpation Aside from these exceptional cases, *induration* of the base or margin of a lesion is the pathognomonic sign of cancerous formation Induration is the paramount sign of neoplastic invasion, and no other pathologic process displays this sign to this extent The indurated, pearly, rolled margin which represents infiltrating neoplastic tissue invariably is associated with oral cancer Finally, palpation of the regional lymph drainage areas may demonstrate one or more enlarged and indurated lymph nodes due to secondary spread from primary carcinoma in oral mucous membrane While very rarely complicating a benign tumor, *ulceration* and *inflammation* are common with cancerous formation

Through coordination of essential findings the clinical diagnosis of oral lesions will prove accurate in distinguishing between benign and cancerous growths on the various surfaces of the oral cavity in at least 75 per cent of all cases

Benign tumors, may they be ever so insignificant, are abnormal and can at any time undergo carcinomatous change if exposed to prolonged

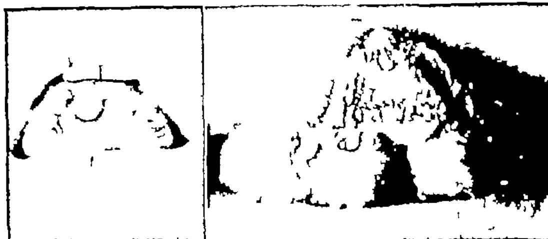


FIG 1 (*Left*)—Papilloma of the tongue This benign tumor was incited by trauma. It has a papillomatous form with a narrow base, normal surface epithelium and an absence of induration or fixation

FIG 2 (*Right*)—Hemangioma of the tongue A spherical mass on a narrow base with a reddish blue coloration normal-appearing mucous membrane and an absence of induration.



FIG 3—Lipoma of the tongue This benign tumor on the right border shows an interstitial swelling, with a pale mucous membrane covering a mass of soft consistency and a well-defined margin

FIG 4—Carcinoma of the tongue This papillary, broad-based, irregular, and ulcerative growth with induration suggests superficial invasion of the underlying tissues.



FIG 5—Carcinoma of the tongue Clinical criteria short history, ulceration with a characteristic pearly, rolled margin, fixation, and induration

irritation or trauma, therefore they should be watched carefully or preferably should be excised at once.

When examining the oral cavity it is essential to question the patient carefully for all subjective symptomatology and to note any abnormalities It is within the scope of the dentist and physician to visualize all oral pathologic entities and a constant awareness of the possible presence of neoplastic disease in any of its various forms is basic for early recognition diagnosis, and treatment

While it is the principal aim of this book to aid in the diagnosis—especially the clinical diagnosis—of tumors and related growths in the oral cavity a brief outline of the treatment of the various conditions is presented without entering into detailed techniques

The treatment of oral cancer is twofold In the first place, an immediate attempt must be made to destroy the primary growth as promptly as possible For effective management of the primary growth however a number of plans have been devised using surgery roentgen rays radium therapy or a combination of these means The choice among the various procedures depends not only on the location of the growth but also on the extent of involvement, the grade of malignancy the danger to surrounding tissues and also on the life expectancy and general physical condition of the patient Ability to use these various means and a thorough understanding of the disease are requisite in the selection of therapy for the most favorable results However metastatic disease in the cervical areas at the time of the primary treatment or developing subsequently is treated surgically With the continuing advances being made in anesthesiology and antibiotic management, as well as in actual therapeutic techniques an increasingly favorable prognosis for oral cancer may be expected.

PART ONE

Introductory Principles for Neoplastic Diseases

CHAPTER 1

THE HISTORY OF CANCER

Medical history insofar as it pertains to cancer can be divided into three eras The first includes observations recorded during the Greek Roman and Byzantine Empires and during the Renaissance This interval covers from c. 460 B C. to 1600 A.D The second period began with the discovery of the microscope and progressed rapidly through the nineteenth century The third began approximately at the turn of the twentieth century when investigators began to study intensively the biological, chemical and etiological phenomena of cancer by experimental means It was at about this time that roentgen rays were discovered (1896) and later radium (1899) two of the most epochal events in the fields of science Both these discoveries were destined to become of paramount importance in the diagnosis and treatment of cancer

Cancer has a long and varied history It is mentioned in the oldest remnants of literature in India and Persia and on down through the ages Sarcoma of bone is described in the earliest Egyptian writings and skeletal remains of the Incas have contained such tumors Egyptians treated ulcerating forms of cancer with arsenical ointments and other escharotics a noneffective treatment of this disease which is still in use in at least two widely advertised "cancer sanitoriums" in America. However even in this early period at least one tumor apparently a lipoma, was treated with the knife

I Early neoplastic literature (c. 460 B.C.–1600 A.D)

A. Hippocrates (c 460–375 B.C.) from available recorded medical literature was the first to classify neoplasms, internal and external, into superficial as well as deep-seated lesions He differentiated between indolent ulcers and progressive lesions which he termed *carcinomas*

B Celsus (c 30 B.C.–38 A.D) a nonmedical patrician who has given us the best history of Roman medicine, was the first to record his achievements in the treatment of cancer

C Galen (c 130–200 A D) was a Greek physician whose doctrines, all based on theory, dominated medical thought for more than 1500 years His restricted humoral theory that cancer was caused by "black bile" led him to advocate such treatments as vegetable diets, colonic irrigations, and nutrient enemas, regimens still used by the uninformed today

D Leonides of Alexandria (c 180 A D) is said to be the first to have used thermal cautery in destruction of cancer in the breast He also advocated removal of tumors, by cautery or excision, which included healthy tissues

E The Renaissance (c 1453–1700), highlighted by such epochal discoveries as the printing press, the circulation of the blood by Harvey in 1628 and of the red blood cells by Malpighi in 1661, produced little advance in the field of cancer. Surgery, however, was improving, and benign and malignant tumors were given separate classification by Marco Aurelio Severino (1580–1656)

II Early concepts of the histologic structure of cancer awaited the improvement of the microscope by Antonj van Leeuwenhoek, who is credited with perfecting the first simple instrument in 1683 Little advancement in the knowledge of cancer was made during the next two centuries, until 1824, when the newly invented achromatic lens further improved the microscope

A Hooke, in 1665, used the term *cell* in describing minute cavities in cork

B. Morgagni (1682–1771), who initiated the scientific study of morbid anatomy, and Rokitansky (1804–1878) are ranked as the two greatest descriptive pathologists

C. Johannes Muller, in 1836, established cellular differences in tumors, and Schwann, in 1839, established the cell theory of animal structure

D Meckel in 1827, traced the origin of buccal carcinoma to the oral epithelium

E Virchow's *Cellularpathologie*, a report of 20 lectures, published in 1858, is one of the greatest books in the history of medicine and earned for its author the title, *the father of cellular pathology*

F. Conheim in 1877 introduced the theory of activation of embryonic rests as the origin of cancer

G Volkmann in 1875 recognized tar and paraffin as external and/or irritative causes of cancer, Harrison described bilharzia cancer of the bladder in 1889, and Rehn described analine cancer of the bladder in 1895

H During the nineteenth century the therapy for cancer was progressing along surgical lines Roux, in 1839, reported the first

major surgical operation for the removal of carcinoma of the tongue In 1884 Sedillot first described the modern technique of dividing the lower lip and mandible for removal of the tongue

III Twentieth-century research in addition to the accumulated studies of morphology and natural history is concerned with the experimental biographical chemical and other phenomena of cancer The study of cancer is based no longer on superstition and dogma but on objective observation and experimentation

A. In the experimental laboratory many discoveries were made among which the following are typical Maud Slye during 1914 through 1937 was actively engaged in selective breeding of mice and reported resistance to cancer in mice as a Mendelian dominant characteristic, and susceptibility as recessive Clunet in 1910 produced with roentgen rays sarcoma in the skin of rats Fibiger in 1913 accidentally discovered a carcinoma in the stomach of a rat which was infected with a nematode worm Yamagiwa and Ichikawa in 1916 produced experimental carcinoma in the ears of rabbits with tar Rous in 1911 produced a sarcoma in the breast of a chicken by the injection of a virus

B Cancer therapy since the beginning of this century has undergone a rapid evolution, as the techniques of surgery radium and roentgen rays have improved

1 Enormous strides in surgical techniques have been made since the development of general anesthesia following Morton's introduction in 1846 of ether as an anesthetic agent and more recently since Lundy's introduction in 1933 of pentothal sodium, with intratracheal oxygen Further with greater knowledge of the physiology and biochemical status of the patient, organs and anatomical areas formerly considered inaccessible to the surgeon have now become relatively frequent sites for radical extirpation The ever-decreasing morbidity and mortality rates are indeed rewarding. Certain oral cancers invading the mandible with cervical metastases, are removed now by radical block dissection in continuity

2. Radiation therapy has achieved the status of a medical specialty since the discovery of x ray by Roentgen in 1896 and of radium by the Curies in 1899 These are most successful modalities when applied to certain types of oral cancers Radical use however is sometimes followed by biological disturbances which may be acute and, in some instances, may have undesirable sequelae even though the cancer is destroyed In the majority of persons having such reactions however the phenomena produced by such intensive treatment are tempo-

rary and are followed by complete healing The most recent investigations in irradiation are concerned with the use of increasing voltages, of which the highest are provided by the betatron, developing from 20- to 100-million-volt electrons The clinical usefulness of radioactive isotopes for neoplastic disease is restricted Currently, radioactive isotopes present a completely new method for exploration into the biology, diagnosis, and treatment of cancer

3 Use of hormones, i e, androgens and estrogens, has become, subsequent to the work of Huggins in 1947, one of the more recent therapeutic innovations for the palliative treatment of certain regional neoplasms

4 Various heavy metals, arsenic, lead, and colloidal gold have been employed in the treatment of cancer The ill effects these substances have on other tissues of the body far outweigh their inhibitory effects on cancer

5 Chemotherapeutic agents of all kinds are currently under investigation in many research institutions Of these, nitrogen mustard compounds show the most promise

READING REFERENCES

BUTLIN, H. T, and W G SPENCER *Diseases of the Tongue* Gassell & Co Ltd, London, 1900

EWING, J "Heredity and cancer," *Bull Am Soc Control Cancer* 24.4–8 (1942)

KRUMBHAAR, E B *Pathology* Paul B Hoeber, Inc, New York, 1937

CHAPTER 2

The Origin of Cancer

Although the importance of the cell and its alterations as the unit of study in the pathology of cancer is well established today the evolution which produced this acceptance spread over some hundreds of years Historically numerous theories have been enunciated as to the origin of these "tumors contrary to nature"

Before briefly discussing a few of the more widely known theories which have been advanced as so-called single causes of cancer we can do no better than to quote Oberling

> Ideas have arisen, tenuous at first, later taking form to crystallize at last in a number of definite conceptions Not yet having been consecrated by experiment, these remain only working hy potheses but even so they have been immensely valuable If some inaccuracies, and even errors must be admitted all hold a germ of truth nevertheless but their highest merit is that they stimulate research and bring about the clash of ideas that under lies all progress

THEORIES ON ORIGIN OF CANCER

Irritation

The theory that irritation causes cancer has found support among modern as well as ancient physicians It long has been known that skin cancers rarely develop in healthy tissue and that not infrequently they are preceded by long periods of irritation e g., from fistulas, ulcers scars and keratoses Oral sepsis the pipestem and chewing tobacco are some of the chronic irritants which most frequently produce changes in the mucous membranes of the lips and mouth that may subsequently progress to cancer

It was thought that the discovery by Pott in 1775 of chimney sweeps carcinoma due to "a logement of soot in the rugae of the scrotum" and the cancers produced by Yamagiwa and Ichikawa in 1916 were proof

that irritation is a cause of cancer. Kennaway and Heiger, however, in 1930, isolated the first cancer-producing hydrocarbon from coal tar They showed that it was a specific chemical compound, and not the irritation, which was the etiologic agent that produced cancer The process is a gradual, progressive one, not a rapid change from a normal cell to a tumor cell In spite of the "cause and effect" the irritation theory offers, it can be applied only to a certain number of neoplasms, for many tumors do arise in tissues where evidence of chronic irritation has not been demonstrated

Embryonal Rests

The theory of embryonal rests as a cause of tumors was introduced when it became apparent that irritation would not satisfy the inquisitive-minded Conheim was the chief champion of the *rest* theory This theory postulates that scattered in various organs and tissues are cells left over as a result of overproduction at the time of the formation of the germ layers Such *rests* were noted around the pituitary, the kidney, the spermatic cord, and in other sites But it was soon apparent not only that there were more tumors than *rests,* but also that tumors appeared at sites where *rests* were not found

Postfetal Rests

This theory was introduced by Ribbert in 1907 when he modified the Conheim theory to include cells isolated by pathologic processes during the life of the individual He believed that there was an alteration of tissue tension which upset the equilibrium between the epithelium and connective tissue, and that this removed the so-called growth restraints and permitted isolated cells to grow independently However, cells have been grown with tissue-culture techniques when these normal restraints were absent, and neoplastic changes have not developed.

The Microbic Theory

This theory was an inviting one, for when Pasteur showed that disease could be, and was, caused by microscopically small organisms, numerous investigators reported the isolation of such organisms from various and sundry neoplasms But it was not until after many years of intensive study, research, acrimonious debate, and a voluminous literature that it was finally concluded that the microorganism found within a tumor was the result of a superimposed infection Much later, Rous in about 1911, produced a tumor in chickens by the injection of cell-free filtrates, the first such tumor proved to be due to a virus Other animal tumors have been caused by viruses, but so far no acceptable proof exists that they are the cause of neoplasms in man.

Current Concepts

The prevailing view today is that cancer is a group of diseases with multiple causes

Cocarcinogenesis With this concept a new hypothesis on the etiology of cancer was introduced—the suggestion that cancer development takes place in two stages The first is initiation the second promotion Initiation probably is instantaneous and its effect irreversible The stage of promotion may be produced by nonspecific agents such as irritants and temperature extremes. Its action is prolonged which may be responsible for the slow development of clinical cancer Early its effect is reversible

Heredity As a factor in the etiology of cancer heredity requires definitive evaluation however it would appear on the basis of observations that a familial as contrasted to a genetic susceptibility does exist

Hormones of the Glands of Internal Secretion It is well known that these hormones have a specific function in growth and metabolism The influence of estrogenic substances on the changes in size of the breast in women during the menstrual cycle demonstrates the phenomenon Such hormones in large doses were used initially by Goormaghtigh and Amerlinch in 1930 to produce breast carcinoma in rats Other hormones particularly those of the testicle and the adrenal and pituitary glands are playing an increasingly important role in experimental cancer

The Laws of Field Behavior The laws of field behavior of normal tissue apply as well to neoplasms It is no longer thought that neoplasms are completely autonomous for they apparently never wholly escape the laws of growth and restraint of the tissues in which they arise

READING REFERENCES

EWING J *Neoplastic Diseases a Treatise on Tumors* 4th ed W B Saunders Company Philadelphia 1940

LIPSCHUTZ, A *Steroid Hormones and Tumors* The Williams & Wilkins Company Baltimore, 1950

OBERLING C *The Riddle of Cancer* 3d ed Yale University Press, New Haven, 1946

CHAPTER 3

Classifications of Oral Neoplasms

Numerous classifications of oral tumors have been proposed, among them the etiologic, the regional (i e, the organ in which the neoplasm is located or its position in the oral cavity), and the histologic The generally accepted division of tumors is based on the histologic type of cell, its maturity, and growth pattern, however, the structure of a tumor is not always determined by its derivation but sometimes by the metabolism of the cell This is particularly well illustrated in the so-called mixed tumor of the salivary glands, where the secretions from the epithelial tumor cells accumulate in the stroma and result in chondroid and myxomatous changes

In most instances a tumor receives its name according to the cell of origin or, where this is not possible, from the tissue from which it arises Benign tumors offer little difficulty as a rule, but malignant tumors are more involved For the most part they may be classified under two major divisions carcinoma and sarcoma The histologic classification, therefore, is adaptable to the structures of the oral cavity

EPITHELIAL TUMORS

While the oral mucosa properly consists of both epithelium and the intimately associated lamina propria (papillary connective tissue), these tumors arise only from the epithelial portions of the mucosa, which consist of stratified squamous epithelium Glandular epithelium is found in the submucosa and is also a source of this group of tumors The structure and thickness are adaptable to physical and thermal trauma For this reason the mucosa proper is thicker on the lips, tip of the tongue, and hard palate than on the floor of the mouth and soft palate Tumors on the various surfaces have different growth characteristics and will be described more completely in the chapter devoted to specific areas

Papilloma

A papilloma is an outgrowth from the oral surfaces Its structure depends on whether proliferation is primarily initiated in the epithelium

or in the supporting connective tissue Where the epithelial component is predominant, the mucosa covers fingerlike processes or ridges of stroma. Where the connective tissue component is most prominent, a globular smooth projection is covered by a relatively thin uniform mucosa The majority of the latter cases are in reality pseudotumors resulting from trauma

Epidermoid, or Squamous-cell, Carcinoma

This is by far the most common malignant epithelial tumor of the oral cavity With few exceptions (such as on the base of the tongue) the histologic pattern is of a low grade (I or II) (See Table 1 for data on the incidence of squamous-cell carcinoma)

Glandular Tumors

Such tumors arise from mucosal appendages the major and minor salivary glands

1 The *adenoma* is a rare benign epithelial neoplasm which takes origin from acinar or duct epithelium
2 The *adenocarcinoma* is the malignant analog of the adenoma
3 The *benign mixed tumor* characteristically shows both epithelial and connective tissue-like components which are considered to be either epithelial in derivation or the result of induction by epithelium therefore the term *mixed* may be used in the descriptive or derivative sense.
4 The *malignant mixed tumor* shows structural characteristics of both a mixed tumor and an adenocarcinoma

Ameloblastoma

Ameloblastoma is a locally invasive epithelial tumor potentially capable of differentiating into carcinoma. It is usually located in the jaw

Benign Pigmented Nevi

These nevi are classified as junctional compound intradermal and juvenile melanomas These lesions have a controversial histogenesis. In the opinion of some they are derived from the melanoblast and Schwann cells of peripheral nerve terminations Others believe them to be derived from the basal cells of the epidermis of the mucosa. In any case it is necessary for junctional changes to be present before malignant transformation can occur The junctional changes vary from moderate increase in pigment in the basal-cell layer with numerous clear cells to nests of these cells accumulating at the dermoepidermal junction As this process continues these cells drop off into the dermis and, when the process is complete separation occurs and an intradermal nevus is formed When

both the junctional and the intradermal nevi coexist, the term *compound nevus* is used Although rare in the oral cavity, it is a common cutaneous lesion.

The so-called juvenile melanoma, which may occur in adults, is characteristically seen before puberty This lesion resembles a melanoma more than a junctional nevus and has certain distinguishing characteristics which delineate it from a melanoma It is well described in the literature.

Primary Melanoma

Primary melanomas are classified as intraepithelial or invasive, the latter as superficial or deep The intraepithelial type is characterized by bizarre pagetoid cells generously sprinkled throughout the epidermis or mucosa The only criterion necessary for a diagnosis of an invasive melanoma is the presence of malignant junctional activity in close association with the invading malignant cells

CONNECTIVE-TISSUE TUMORS

Connective tissue supports the epithelium of the oral cavity In most places the epithelium is supported and nourished by a fat-containing, loose, connective-tissue structure, particularly the cheeks and soft palate. Where surfaces are subject to trauma (hard palate, dorsum of the tongue, and gingiva), the submucosa is absent and the mucosa is firmly attached to the underlying periosteum or muscles There is a rich supply of nerves, lymphatics, and blood vessels coursing throughout the supporting structures

The tumors arising from the connective tissues proper and the various other structures closely associated with them are a heterologous group of neoplasms The normal differentiation of tissue from primitive mesenchyme results in the formation of the body components, i e , muscle, connective tissue proper, bone, hematopoietic tissues, blood and lymph vessels, and the reticuloendothelial system There remains, after this differentiation has occurred primitive mesenchyme in close association with the capillaries throughout the body This mesenchyme has the same potentialities as did that which formed the various body tissues The name given to a neoplasm of these tissues is derived from these cells (fibroblast, myoblast, lipoblast, osteoblast, chondroblast etc) The names designate varying forms and functions of descendants of a common ancestry The morphologic appearance of the various types of neoplastic cells depends upon their biochemical cytoplasmic activity Usually, the benign and malignant tumors arising from the various descendants of the primitive mesenchyme adhere to a growth pattern characteristic of

their intermediate cell of origin However because of the very fact that we are dealing with neoplastic rather than normal cells it is not unusual to find more than one cell type or a neoplastic cell in the guise of another cell together with various types of matrix (collagen bone cartilage etc)

1 *Fibroma* the benign tumor of the fibroblast associated with a variable amount of collagen
2. *Fibrosarcoma* the cancerous counterpart of the fibroma. It also arises from the fibroblast
3. *Lipoma* the benign tumor of fat which arises from the lipoblast
4 *Liposarcoma* the cancerous counterpart of the lipoma. It arises from the lipoblast and rarely secondarily from cells within a lipoma.
5 *Granular-cell myoblastoma* a benign tumor of debatable origin arising from either skeletal muscle or nerve sheath cells
6. *Rhabdomyosarcoma* the malignant tumor arising in or closely associated with structures of skeletal muscle It is generally conceded that there is no benign counterpart

RETICULOENDOTHELIAL TISSUE TUMORS

The reticuloendothelial system is composed of a family of cells many of which have the power of phagocytosis and of forming reticulum Some of these can be impregnated with silver carbonate These cells line the sinusoids and capillaries of the hematopoietic system lymph nodes spleen and liver and occur also in the perivascular spaces throughout the various tissues and organs of the body The cells composing this system are designated differently by various authors The most primitive cell is called the fixed stem cell (primitive reticular cell) This cell differentiates into two main cellular components e g reticuloendothelial cell which manufactures reticulum lines sinusoids is phagocytic, and gives rise to the common macrophage, and the free-stem cell (myeloblast or lymphoblast, as well as other blood cells) The term *malignant lymphoma* is used to describe a group of sarcomas occurring in this system i e giant follicular lymphoma, lymphosarcoma Hodgkin s disease reticulum cell sarcoma, lymphatic leukemia and monocytic leukemia The necessity for employing these subdivisions of the malignant lymphomas other than the giant follicular lymphoma is open to question for they are interrelated they all adopt a variable histologic picture (even in the same region or node) and the prognosis apparently is not always related to a certain histologic type The lymphoma most probably starts as a giant follicular lymphoblastoma and progresses into interrelated variants of a more malignant character The follicular lymphoblastoma is characterized by an increase in follicles distortion of nodal pattern and lack of phago-

cytoses in the germinal centers This leaves but two other diseases of the reticuloendothelial system, which are described separately. myeloid leukemia and myeloma

Lymphosarcoma

Either a lymphocytic or a lymphoblastic sarcoma of lymphoid tissue, lymphosarcoma is rarely seen primarily in the oral cavity

Hodgkin's Disease

A form of malignant lymphoma, Hodgkin's disease is composed of various types of cells, i e , lymphocytes, plasma cells, eosinophils, fibroblasts, and a giant reticulum (Reed-Sternberg) cell The latter may be mononucleated, binucleated, or multinucleated, but it must be present in order to make the diagnosis of Hodgkin's disease

Reticulum-cell Sarcoma

This type of sarcoma may also be quite pleomorphic It has as its cell of origin either the fixed-stem cell or the reticuloendothelial cell

Myeloma

A tumor of the plasmoblast, a myeloma may be either solitary or multiple.

Leukemia

Leukemia (except myeloid and myeloma) is a disease in which the circulating blood contains the malignant cells of one of the lymphomas, namely, the lymphosarcoma (lymphocytic leukemia), the reticulum-cell sarcoma (monocytic leukemia), or Hodgkin's disease (lymphocytic or monocytic leukemia).

Myeloid Leukemia

As a rule, myeloid leukemia has no tumor formation and is limited to hemopoietic tissue It is a neoplastic overproduction of the granulocytic series of white blood cells, and characteristically the peripheral blood has numerous immature white cells normally found only in the bone marrow

Plasma-cell Leukemia

This type of leukemia is rare and may follow either the solitary or multiple forms of the disease The peripheral blood contains numerous plasma cells

BLOOD AND LYMPH VESSEL TUMORS

Hemangiomas

Single or multiple aggregations of vasoformative tissue hemangiomas are seen most frequently in the head and neck regions They frequently occur on the lips and on the tongue but rarely on other oral surfaces While hemangiomas in the oral cavity are usually single, they may be multiple Both forms may be associated with von Recklinghausen s neurofibromatosis hemangioma of the eye (von Hippel s disease) hemangiomas of the cerebellum (Lindau s disease) as well as with hemangiomas of other organs of the body Some hemangiomas are true neoplasms while others are vascular aggregates variously interpreted as being hamartomas or malformations The hemangioma is classified as capillary cavernous and mixed and is further discussed in Chapter 7

For practical purposes it is often difficult to distinguish, either clinically or pathologically a true tumor from a hamartoma or a malformation

1 The *true benign blood vessel tumor* is one in which there is a minimum intercommunication with the surrounding normal blood vessels The cells proliferate without regard to the part in which they are located and do not grow in accordance with the organ as a whole.
2. The *hamartoma* is an excessive localized growth of vascular tissue which although it is normal to the region involved, differs from a true tumor in that it lacks progressive growth propensities. The cellular differentiation is usually but not always similar to that found in other parts of the organ however the tissues are abnormal in quantity or distribution
3. A *malformation is an anatomic error which is present at birth* grows only with the growth of the body and does not infiltrate surrounding tissues

Hemangiosarcomas

These are rare malignant tumors arising *de novo* from vascular endothelium and seldom resulting from a transformation of a hemongioma. A great variation in biologic behavior is seen some hemangiosarcomas being of an indolent type with late metastasis while others grow rapidly and metastasize early

NERVE-TISSUE TUMORS

Tumors of the peripheral nervous system are few in number but have quite a varied histologic appearance It is rather generally accepted now that these tumors are derived from the sheath of Schwann cells, which are traceable to the neural crest These cells are quite versatile and are capable of synthesizing a collagen matrix, multiplying rapidly, and assuming the guise of a fibroblast The tumors, although morphologically mesodermal in appearance, are ectodermal in origin For our purposes, only two forms need be discussed the encapsulated benign form (neurilemmoma) and the unencapsulated benign as well as malignant forms (neurofibroma and malignant schwannoma) The neurofibroma may be solitary and unrelated to the multiple form, the latter is better known as von Recklinghausen's disease (multiple neurofibromatosis)

1 *Neurofibroma* an unencapsulated benign tumor arising from the Schwann cell, with associated proliferation of the neurites The amount of collagen present varies
2 *Neurilemmoma* an encapsulated benign tumor arising from the same cells as does the neurofibroma but without the associated proliferation of the neurites Its histologic appearance is quite variable, depending on cellularity, edema, etc, but usually nuclear palisading is a prominent feature in some portions of the tumor
3 *Neurofibromatosis* the multiple form of the unencapsulated neurofibroma It is a widespread disease associated with a strong hereditary background It may grow in a number of ways but usually proliferates as isolated small tumors at the end of the nerve If the proliferation occurs inside the nerve sheath, the nerves become tortuous, thickened, and plexiform The proliferation may be diffuse with plaquelike thickenings or with large, apronlike folds of skin, which hang grotesquely from various regions of the body Bones may be involved by pressure from without or expansion from within
4 *Malignant schwannoma* the cancerous form of either the multiple or solitary unencapsulated neurofibroma, but not of the encapsulated benign neurilemmoma

TERATOMA

A teratoma is a true tumor composed of numerous tissues foreign to the part These usually occur in the gonads, but extragenital locations occasionally involved by such neoplasms are the pineal gland the thymus gland and the retroperitoneal tissues These benign forms have mature

tissue components while the malignant teratomas have a variety of im mature neoplastic structures

The lesion commonly designated as a dermoid cyst, occasionally located in the midline of the oral cavity is not a teratoma but a sequestration cyst It is a developmental and not a neoplastic process and is always benign.

DISCUSSION

In addition to the nomenclature used in the above classification certain tumors do not occur in pure form but contain metaplastic tissues of one or more types e g. fibroma with cartilage and bone (fibrochondrosteoma) We prefer the descriptive rather than the compound name for it permits greater simplicity in classification without altering accuracy

The foregoing classification is based primarily on histology Where necessary as in the mixed tumors of salivary gland origin and the ameloblastoma the basic classification is modified by the more acceptable concepts of the histogenesis of these tumors

READING REFERENCES

ALLEN A C. and S SPITZ "Malignant melanoma, a clinicopathological analysis of the criteria for diagnosis and prognosis," *Cancer* 6:1–45 (1953)

BANGLE, R J., JR "A morphological and histochemical study of the granular cell myoblastoma," *Cancer* 5:950–965 (1952)

MCCARTHY W D and G T PACK "Malignant blood vessel tumors A report of 56 cases of angiosarcoma and Kaposi s sarcoma," *Surg Gynecol Obstet* 91:465–482 (1950)

MASSON P "My conception of cellular nevi" *Cancer* 4:9–38 (1951)

PACK, G T and W F EBERHARDT "Rhabdomyosarcoma of skeletal muscle. Report of 100 cases," *Surgery* 32:1023–1064 (1952)

SHARP G S W K BULLOCK, and F C BINKLEY "Ameloblastoma of the jaws," *Oral Surg Oral Med Oral Pathol* 8:1013–1025 (1955)

STOUT A P "Liposarcoma the malignant tumor of lipoblasts" *Ann Surg* 119:86–107 (1944)

STOUT A P "Tumors of blood vessels," *Texas State J Med* 40:362–365 (1944)

STOUT A P "Pathology and classification of tumors of soft tissues," *Am J Roentgenol. Radium Therapy* 66:903–909 (1951)

CHAPTER 4

THE BIOPSY

The oral diagnostician is responsible for detecting all oral lesions which are or may become cancer He must take advantage of every available source of information in order to make a final diagnosis Taking a complete history and examining the mouth, as well as inspecting and palpating the presenting lesion, are essential A clinical impression is then formed which can be confirmed only by biopsy

Anyone qualified to assume the obligations of diagnosis must be prepared to obtain adequate and timely biopsies or to arrange immediate referrals for this relatively simple procedure A high index of suspicion of all abnormal processes and knowledge of a few fundamental techniques are required for this final diagnostic step

DEFINITION

Biopsy is the removal of tissue from a living patient for microscopic examination with an implied purpose of guiding treatment Three steps are required by this definition (1) the biopsyist must select the best method for obtaining adequate tissue for removal, (2) the pathologist must confirm the tissue of origin must determine existing neoplasms, identify malignancy when present and assign a degree or grade to the tumor, (3) by the summation of the clinical and pathological findings, the physician must then formulate the best possible treatment for each individual case The cooperation of the clinician and the pathologist is most important in identification of neoplastic diseases

Types of biopsies are the same for the oral cavity as for other parts of the body The common methods involve sharp dissection, a punch or an aspiration procedure For small nodules or ulcers and frankly benign lesions an excisional biopsy is performed Larger lesions are divided into two groups

1 Ulcerous lesions The most desirable site for removal of tissue in this type of lesion is at the junction of the ulcer and surrounding viable

tissue Neither the central necrotic area nor the crust on the surface is of value for microscopic diagnosis

2. Nonulcerated lesions In this type of growth an incision is made through the mucous membrane and an adequate portion of the tumor is obtained.

The aspiration biopsy is ideal for cysto-nonulcerated tumors and lesions of bones as well as for cervical nodes. The details of each of these procedures vary in both preparation and interpretation A rapid frozen section is occasionally desirable in office and hospital surgery A section of tissue, or the tumor *in toto* is sent to the pathologist for an immediate diagnosis. This is ideal when a decision must be made for immediate further surgery but it is not routinely recommended

ARMAMENTARIUM

In order to perform a biopsy certain instruments laboratory receptacles with proper tissue-fixative solutions and mailing containers are needed.

Laboratory Receptacles and Fixing Solutions This equipment is furnished by the clinicopathologic laboratory to which specimens are to be sent for diagnosis This laboratory should provide small, stoppered bottles containing 10 per cent Formalin (1 part of 40 per cent formaldehyde to 9 parts of water) and mailing containers If the laboratory is nearby the pathologist may prefer another fixative such as Zenker's or Bouin's solution In any event these receptacles and fixative solutions must be kept in the office at all times

A biopsy summary form including the age and clinical history of the patient location of the specimen removed and the clinical diagnosis should accompany the tissue submitted in order that the pathologist may correlate all information with the microscopic study A carefully planned printed form furnished by the pathologist will automatically suggest attention and completion of it by the biopsyist

Instruments Certain apparatus such as the electric needle or knife for example, is unsatisfactory for obtaining tissue because the result is often complete destruction of the specimen Other widely available and most satisfactory instruments are more properly used

1 A special cup-shaped biting biopsy forceps, of which there are several on the market is the best instrument with which to obtain a tissue specimen

2. The scalpel is in every office and is the instrument most commonly used for this purpose. It is completely satisfactory providing the



FIG 4 1—A special cup-shaped biting forceps is the best instrument with which to obtain a tissue specimen from an erosion or ulceration

tissue specimen is not traumatized The practice of seizing a piece of tissue with a pair of forceps and cutting around it may break up and distort the cellular architecture so that microscopic recognition of the tumor will be impossible The selected biopsy material must be removed completely with the knife blade without the aid of grasping forceps

3 A sharp curet is a satisfactory instrument for any ulcerating lesion A scoop is taken in much the same manner as when the scalpel is used A firm smooth stroke will provide a spherical mass without much trauma

4 The sharp punch is a small circular knife which may be rotated carefully into a tumor for several millimeters The column of tissue thus isolated is then severed at its base with a scalpel

5 A 10-cc Luer syringe and a 16-gauge needle are satisfactory equipment for obtaining tumor tissue or fluid by aspiration The aspiration biopsy is an excellent procedure for inaccessible growths or for tumors where there is a possible risk of introducing infection by incision Specimens so obtained usually are sufficient for the tumor pathologist.



FIG 4 2 (*Upper*)—Leukoplakic plaque surrounded by abnormal atrophic mucous membrane

FIG 4 3 (*Lower*)—The same patient as shown in Fig. 4 2, following an excisional biopsy of the entire area Pathology report stated "Precancerous leukoplakia and abnormal mucous membrane completely removed."

but he should be consulted as to the technique of preserving and submitting the specimen

Note Desiccation or cautery should not be used to control bleeding following the removal of tissue Cotton saturated with Monsel's solution usually is sufficient to stop moderate seepage, and compression of tissue with a suture will serve for more profuse bleeding

ANESTHESIA

The biopsyist is the best judge of the type of anesthesia to be used The conventional methods employed in office practice are suitable for the biopsy procedure

Anesthesia may be applied to the ulcerous surface with cotton saturated in one of the surface anesthetic agents This is frequently sufficient to permit the painless removal of a portion from an ulcer with scalpel, biopsy forceps, or punch

The regional nerve block anesthesia is indicated for tender lesions complicated with inflammation, for nonulcerated growths, and for all tumors of bone It may be accomplished with procaine hydrochloride 2 per cent, with or without Adrenalin Moderately effective anesthesia is desired, but prolonged anesthetic action for these simple procedures is unnecessary

Local infiltration anesthesia may be employed for most soft-tissue growths, but the anesthetic solution should be injected widely around the base of, rather than in, the tumor

PROCEDURE

The biopsyist decides whether to use a scalpel, punch, forceps, or curet. The much-condemned electrodesiccation technique which has been employed in the past to destroy small clinically suspicious lesions has resulted in the destruction of local evidence of the original primary lesion and the later appearance of metastatic cervical nodes

The surface over the lesion to be biopsied is painted with an antiseptic If a nerve block is to be used the site for the insertion of the needle is similarly prepared

The appropriate anesthetic agent is applied topically or injected, as indicated

Access to the lesion and to the portion to be removed dictates the proper biopsy instrument for a particular growth Regardless of the instrument used, the tissue must be removed without being squeezed

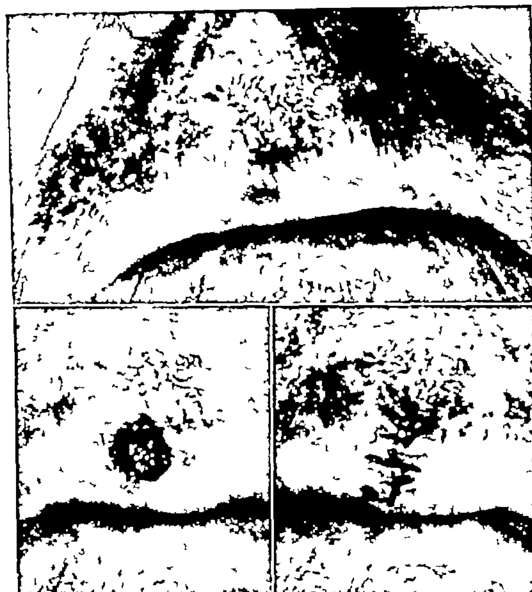


FIG 4 4 (*Upper*)—Minute carcinoma arising in the mucocutaneous border in the midline of the upper lip

FIG. 4 5 (*Lower left*)—Same patient as in Fig 4 4 following removal of the carcinoma with the scalpel for biopsy as well as for cure

FIG 4 6 (*Lower right*)—Same patient shown in Figs 4 4 and 4 5 following an excisional biopsy The pathology report stated, "Squamous carcinoma with normal tissues on all sides and beneath the growth."

or traumatized and must be immediately placed in the proper fixative

4. The specimen should be promptly forwarded to the clinicopathologic laboratory in order to arrive on a time schedule for proper tissue processing. Such cooperation with the pathologist will expedite the report

SUMMARY

The patient who is to have a biopsy should be told of the importance of the procedure, and he should know that another specimen is occasionally required before a definite diagnosis can be made

The fate of the patient depends on the course of action instituted when a suspicious lesion in the oral cavity is first detected After the biopsy report, careful planning is required to determine the method of treatment best suited to the individual case

Teamwork between the biopsyist and the pathologist will reduce errors to a minimum When a pathologic report is returned which does not coincide with the clinical impression, a further consultation with the pathologist is essential, and possibly a repeat biopsy will be necessary

READING REFERENCES

BOYLE, P E "Who should take the biopsy? *Oral Surg Oral Med Oral Pathol* 8 118–122 (1955)

FOORD, A G *Biopsy—Indications, Techniques, and Safeguards*, California Cancer Commission Studies 1950, Chap 4, pp 14–16

STOOPACK, J C "Biopsy techniques in oral surgery," *Oral Surg Oral Med Oral Pathol* 5 1034–1046 (1952)

CHAPTER 5

PRECANCEROUS PATHOLOGY

Certain abnormal states of the epithelium are observed in all patients with oral cancer These *alterations are as well demonstrated grossly as* microscopically and they may be divided into localized lesions or large areas of abnormal mucous membrane. Precancerous lesions are recognized as playing an important role since they not only may precede cancerous changes but are actually associated with carcinoma. Precancerous pathology includes investigation of abnormal areas of oral epithelium i e. areas of epithelium that have been altered or preconditioned by regional or constitutional carcinogenic factors

Most observers believe, however that cancer is preceded by abnormal conditions which are not and cannot be called cancer but which do provide a favorable atmosphere for its development. Assuming that precancerous pathologic conditions do exist, it is requisite that those changes which can be classified as precancerous be analyzed in order that their nature may be recognized and steps taken to prevent the subsequent formation of cancer

MICROSCOPIC PATHOLOGY

Certain microscopic changes in the oral mucosa are considered to be precancerous. They may be listed as follows

1 *Dyskeratosis* an irregularity of maturation, benign or malignant, of the cells from the basal cell upwards. This occurs in several conditions with the production of bizarre and oddly shaped cells premature and abnormal keratinization, hyalin degeneration, and hydropic changes within the cell. Leukoplakia of the precancerous type displays all four of the described microscopic changes Leukodema, recently described as a precursor of leukoplakia displays only the inflammatory edema of the connective tissue and moderate hyperkeratosis
2. *Hyperkeratosis* a thickening of the corneous surface layer which is a protective response to pressure irritation, and other causes of inflammation

3 *Acanthosis* a benign and marked epithelial hyperplasia
4 *Parakeratosis* a condition present in a variety of affections of the mucous membrane In addition to an increase in the corneous layer, as in hyperkeratosis, there is a retention of nuclei which is called parakeratosis
5 *Atrophy* a common epithelial change surrounding oral cancer. This microscopic change results from a loss of the elastica, a thinning of the submucosa, and a diminished number and/or absence of mucous glands Lingual papillae are absent, although there is usually a simple hypoplasia without the above-described changes Multicentric foci of carcinoma are frequently found in these areas

Carcinoma in situ is usually multicentric and is definitely an intra-epithelial carcinoma

When cancerous change has developed, the squamous cells often lose their intercellular bridges, become less cohesive, and invade the submucosa In the basal-cell layer, the sharp line of demarcation between the underlying submucosa becomes obscured by the proliferating altered cells All the above precancerous changes may be present together with chronic inflammation

CLINICAL CHARACTERISTICS

Leukoplakia

This is the most common precancerous lesion It is considered to be due to extraneous stimuli which in normal mucous membrane would



FIG. 5 1—Precancerous leukoplakia on an irritated, dry lower lip attributed to an overexposure to actinic rays or other climatic elements

produce only inflammation Leukoplakia should be differentiated from lichen planus The latter is considered to be a dermatologic lesion which is frequently found in the oral cavity before any cutaneous manifesta

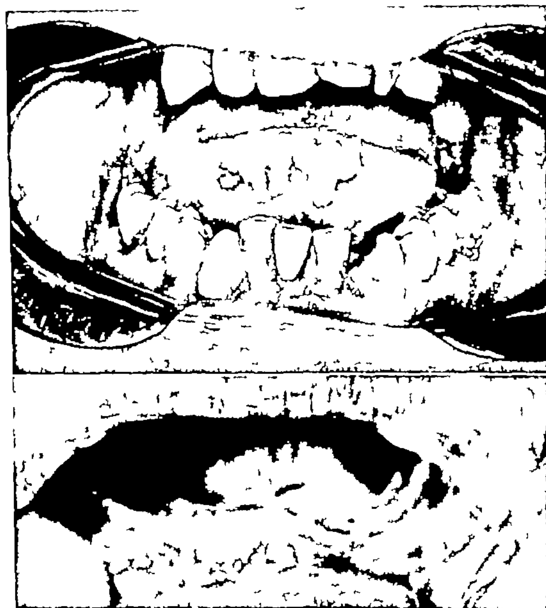


FIG 5 2 (*Upper*)—Precancerous leukoplakia associated with long-standing oral sepsis and irregular jagged, sharp teeth

FIG 5 3 (*Lower*)—Advanced precancerous leukoplakia caused by edentulous mastication

tions or even without any such lesions. A leukoplakic process can form over an area of lichen planus in which case the diagnosis becomes diffi cult. Because of the resemblance microscopically between leukoplakia and lichen planus the differentiation may be difficult even with a biopsy

Incidence Although leukoplakia is most common on the tongue and inside the cheeks, it occurs also on the gingivae, hard palate, and lips When the process is generalized, it may appear on the floor of the mouth



FIG 5 4 (*Upper*)—A benign pseudopapilloma partially covered by precancerous leukoplakia The lesion is of traumatic origin from a broken tooth.

FIG 5 5 (*Lower*)—Irregular plaque of precancerous leukoplakia with a minute thickening along its inferior border which microscopically showed carcinoma in situ

soft palate and anterior tonsillar pillar, but it is not found on the tonsils or in the pharynx

Etiology. Patients with prolonged inadequate diets especially those deficient in the vitamin-B complex are more apt to develop leukoplakia than those who are adequately nourished Some observers believe that a low-protein intake lowers the ability of the mucous membrane to withstand irritation However, certain constitutional variations of individuals



FIG 5 6—Advanced leukoplakic plaque with a lesser degree of leukoplakia posteriorly and an abnormal mucous membrane along the entire side of the tongue Microscopically early evidence of carcinoma was seen beneath the plaque



FIG 5 7—Extensive precancerous leukoplakia with a secondary pseudopapilloma developing, which on microscopic study showed early carcinomatous changes

must be recognized in studying the development of leukoplakia. Just as the fair-skinned individuals, especially red-haired persons, are more sensitive to actinic rays than are brunets or dark-skinned persons, so will the mucous membrane of different individuals show a variation in the degree and manner of response to irritation. The following irritating factors must be considered:

DENTAL FACTORS. Long-standing oral sepsis must be considered as a contributing factor in leukoplakia seen along the gingiva in a poorly cared-for mouth. Jagged teeth and ill-fitting dentures must also be considered as sources of irritation which contribute to a localized, thickened, plaquelike type of leukoplakia.

CLIMATE AND EXPOSURE. Leukoplakia of the vermilion portion of the lips is more common in a warm, dry area than in a cool, damp climate. Exposure to the drying effect of wind and to the actinic rays of the sun contributes to the development of this lesion. It is more frequent in those who are exposed to the elements than in office workers.

CHEMICAL IRRITANTS. Undiluted mouth washes, irritating tooth pastes, snuff, wine, spicy foods, tobacco, and some drugs are a few of the more common chemical irritants which, if used injudiciously or excessively, may produce leukoplakia in the susceptible individual.

THERMAL IRRITANTS. Chronic use of hot food, both solid and liquid, or the pipestem can produce thermal injury. The inhalation of fire in the presence, for instance, of a gas explosion can produce a single intraoral burn. Mucosal injury equivalent to a third-degree burn from such an accident predisposes to subsequent carcinomatous development.

MECHANICAL IRRITANTS. Persistent nervous biting of the mucous membrane of the cheeks or a foreign body such as a pipestem may cause mechanical irritation to such a degree that leukoplakia will develop. The lesion associated with habitual use of a pipe has been named *smokers' patch*.

CANCEROUS CHANGE. Any abnormal mucous membrane, as well as the above precancerous lesions, may at any time develop cancer. Patients with leukoplakia have been followed for from five to twenty-five years without detecting any sign of malignancy, while in other instances cancer has developed on the tongue within six or eight weeks following the appearance of leukoplakia opposite a sharp edge on a broken tooth. Patients with advanced forms of leukoplakia and particularly those who have developed one oral carcinoma, should be kept under close observation because of their tendency to develop subsequent primary carcinomas.

Histopathology. One or all of the precancerous microscopic changes (acanthosis, parakeratosis, hyperkeratosis, dyskeratosis) are present and are associated with varying degrees of inflammation, usually of a chronic nature.

Appearance Two different varieties of whitened mucosa are recog nized clinically one appears as a thin lacy translucent or gray film which has a tendency to be generalized in distribution (termed *leu kodema*) and may be considered a forerunner of the second type The second type of leukoplakia appears as an opaque patch which may be



FIG 5 8—Completely abnormal mucous membrane with hyperkeratosis precancerous leukoplakia, and atrophy in association with an early minute car cinoma on the left side of the dorsum of the tongue.

thick or thin—a white hornified leathery plaque sometimes quite irreg ular and roughened.

Keratosis

This is a localized or diffuse, scaling or crusting lesion on the ver million portion of the lips. Irritation as a result of exposure to windburn sunshine and dry climate as well as trauma from nervous habits and the adhesion of cigarette paper may produce keratosis

Atrophy of Oral Mucous Membranes

Atrophy is a common precancerous condition and is considered to be the epithelial change which is the opposite of leukoplakia. Areas of

smooth, pale mucosa with loss of normal markings are seen Characteristically, this appearance is also observed on lower lips of older individuals, or on those who have had excessive climatic exposures resulting in a loss of the normal linear markings and leaving a smooth pale surface Intraorally, the appearance is similar, particularly on the dorsum and sides of the tongue, while on expansile surfaces as on the cheeks, it is further demonstrated by a wrinkling of the surface suggesting a loss of supporting submucosal tissues Biopsy is as important in these atrophic areas as it is in leukoplakia

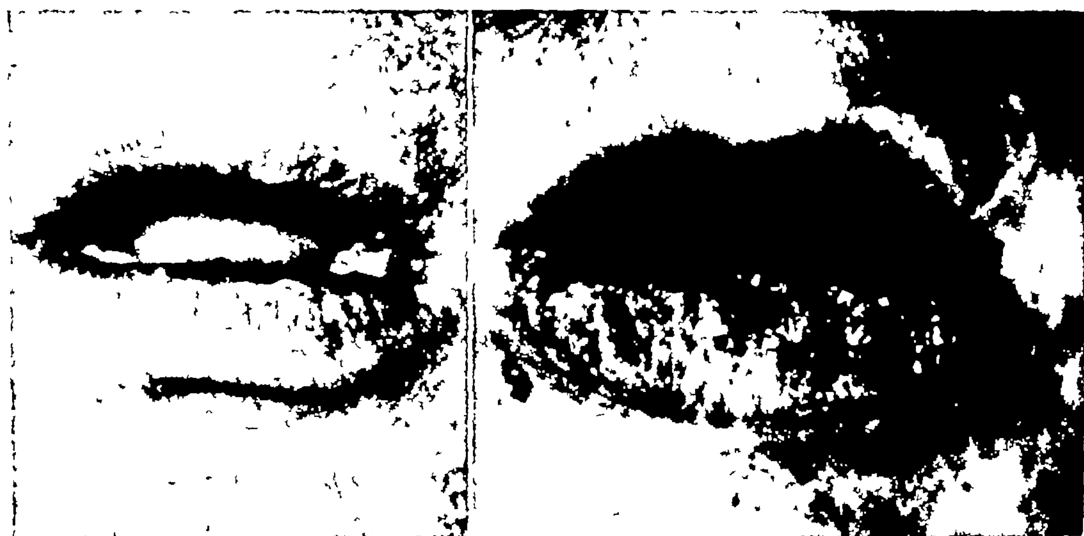


FIG 5 9 (*Left*)—Hyperkeratoses covering the entire vermilion epithelium of the lower lip and, to a lesser degree, the upper lip

FIG 5·10 (*Right*)—Advanced hyperkeratotic formation over the lower lip in a patient hypersensitive to actinic rays

Ulcers

Ulcers may result from an acute or chronic process Trauma from sharp edges of teeth, dental appliances, or repetitive biting is a common occurrence and may cause such lesions on the lip, cheek, and tongue

Cicatrix

Cicatrix is a result of a reparative process It is composed of a dense connective tissue which results from injury or disease While not commonly observed on oral mucous membrane, it is associated with delayed healing, through-and-through puncture wounds in the lips, and burns Early, these areas are well supplied with capillaries; later, when contraction of the scar has occurred, blood vessels are diminished in both size and number and cancerous changes are observed—especially in cicatrices of thermal origin.

Radiation Changes (Late)

Such changes are the result of the unwarranted use of x ray for the treatment of acne, or for epilation. Progressive changes are produced in the exposed skin and underlying mucous membrane Years later an atrophy of the mucous membrane and degeneration of the connective tissue develop When fissures and ulceration occur the eventual appear ance of cancer may be expected

Syphilis

Syphilis is truthfully said to mimic any and every known disease Luetic glossitis with leukoplakia, mucous patches gummas, and chancre are seen in the mouth, varying with the degree and manner of tissue response to the irritation from either the spirochetes or the heavy metals formerly used in the treatment of the disease. The development of cancer on luetic lesions is not so common as was once thought however it occurs often enough for the syphilitic lesion to be considered precan cerous

TREATMENT

Localized precancerous lesions are best treated by excisional biopsy Careful and intelligent observation is necessary when the condition is generalized As soon as any localized change is noted in such a diffuse area, a biopsy is imperative and appropriate treatment must be insti tuted at once. If the irritating factors can be determined and eliminated the precancerous condition may be arrested or may disappear completely In case this fails excision of the area is recommended, with repair by sliding mucosal or split thickness skin grafts, unless regular follow up observation is possible.

READING REFERENCES

KOLLAR, J H., C. W FINLEY J M NABERS B RITCHEY and B J ORBAN "Leukoplakia," *J Am Dental Assoc* 49:538–548 (1954)

SHARP G S "Cancer of the oral cavity" *Oral Surg Oral Med Oral Pathol* 1:614–631 (1948)

WOODBRIDGE, H "Carcinoma in situ diagnosis and study of a case," *Oral Surg Oral Med Oral Pathol* 3:1447 (1950)

smooth, pale mucosa with loss of normal markings are seen Characteristically, this appearance is also observed on lower lips of older individuals, or on those who have had excessive climatic exposures resulting in a loss of the normal linear markings and leaving a smooth, pale surface Intraorally, the appearance is similar, particularly on the dorsum and sides of the tongue, while on expansile surfaces, as on the cheeks, it is further demonstrated by a wrinkling of the surface suggesting a loss of supporting submucosal tissues Biopsy is as important in these atrophic areas as it is in leukoplakia

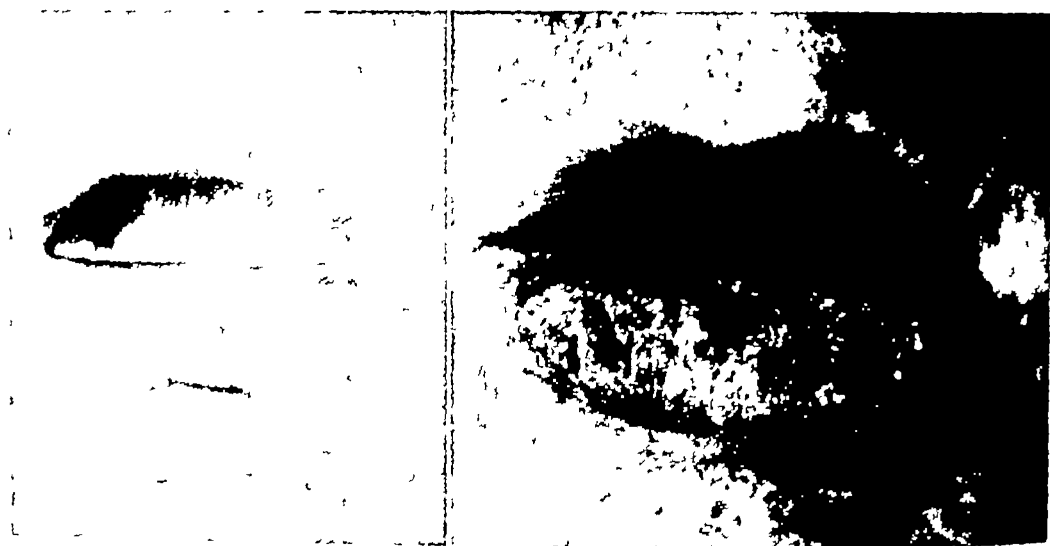


FIG 5 9 (*Left*)—Hyperkeratoses covering the entire vermilion epithelium of the lower lip and, to a lesser degree, the upper lip

FIG 5 10 (*Right*)—Advanced hyperkeratotic formation over the lower lip in a patient hypersensitive to actinic rays

Ulcers

Ulcers may result from an acute or chronic process Trauma from sharp edges of teeth, dental appliances, or repetitive biting is a common occurrence and may cause such lesions on the lip, cheek, and tongue

Cicatrix

Cicatrix is a result of a reparative process It is composed of a dense connective tissue which results from injury or disease. While not commonly observed on oral mucous membrane, it is associated with delayed healing through-and-through puncture wounds in the lips, and burns Early these areas are well supplied with capillaries, later, when contraction of the scar has occurred, blood vessels are diminished in both size and number and cancerous changes are observed—especially in cicatrices of thermal origin

Radiation Changes (Late)

Such changes are the result of the unwarranted use of x ray for the treatment of acne or for epilation. Progressive changes are produced in the exposed skin and underlying mucous membrane. Years later an atrophy of the mucous membrane and degeneration of the connective tissue develop When fissures and ulceration occur the eventual appearance of cancer may be expected

Syphilis

Syphilis is truthfully said to mimic any and every known disease. Luetic glossitis with leukoplakia mucous patches gummas and chancre are seen in the mouth varying with the degree and manner of tissue response to the irritation from either the spirochetes or the heavy metals formerly used in the treatment of the disease The development of cancer on luetic lesions is not so common as was once thought however it occurs often enough for the syphilitic lesion to be considered precancerous

TREATMENT

Localized precancerous lesions are best treated by excisional biopsy Careful and intelligent observation is necessary when the condition is generalized. As soon as any localized change is noted in such a diffuse area a biopsy is imperative and appropriate treatment must be instituted at once. If the irritating factors can be determined and eliminated the precancerous condition may be arrested or may disappear completely In case this fails excision of the area is recommended, with repair by sliding mucosal or split thickness skin grafts unless regular follow up observation is possible

READING REFERENCES

KOLLAR, J H., C W FINLEY J M NABERS, B RITCHEY and B J ORBAN "Leukoplakia," *J Am Dental Assoc* 49:538–548 (1954)

SHARP G S "Cancer of the oral cavity" *Oral Surg Oral Med Oral Pathol* 1:614–631 (1948)

WOODBRIDGE, H "Carcinoma in situ diagnosis and study of a case" *Oral Surg Oral Med Oral Pathol* 3:1447 (1950)

PART TWO

Tumors
Benign and Malignant
of the Oral Mucosa
and Accessory Cavities

CHAPTER 6

Lesions of the Lips

The lips are so readily available for inspection by the patient as well as by the diagnostician that carcinomatous signs should be detected at an early stage. Unfortunately this is not always the case Often the disease is well advanced when the patient arrives for the first examination

Because there is some difference between the incidence and pathology of carcinoma of the lower lip and of the upper lip they will be discussed separately

APPLIED ANATOMY

The *lower lip* forms the lower half of the anterior wall of the oral cavity and bounds the lower half of the external opening. It varies in thickness size and shape according to the race and age of the individual. The lip is lined with mucous membrane which is a continuation of the cheek and the alveolar process The mucous membrane gradually changes in thickness and glandular structure at the free surface to form the vermilion portion of the lip which ends abruptly at its junction with the skin. Thin muscles with their nutrient vessels and nerves lie just beneath the mucous membrane and skin other skeletal muscle complexes make up the body of the lip

The lymphatics from the central portion of the lip drain inferiorly into the submental nodes those from the lateral two-thirds, in addition, drain latero-inferiorly into the facial and submaxillary nodes However intercommunication between these lymphatics permits metastases within these groups as well as to the contralateral side.

The *upper lip* occupies the upper anterior portion of the oral cavity and is similar in structure to the lower lip Its lymphatic drainage varies from that of the lower lip in that not only are the submental facial, and submaxillary nodes the site of metastases but also the upper cervical and preauricular nodes may be involved.

CARCINOMA OF THE LIPS

Carcinoma may appear in a variety of forms, and early recognition is highly essential in obtaining the most favorable results Any precancerous lesion such as leukoplakia or keratosis should have microscopic study

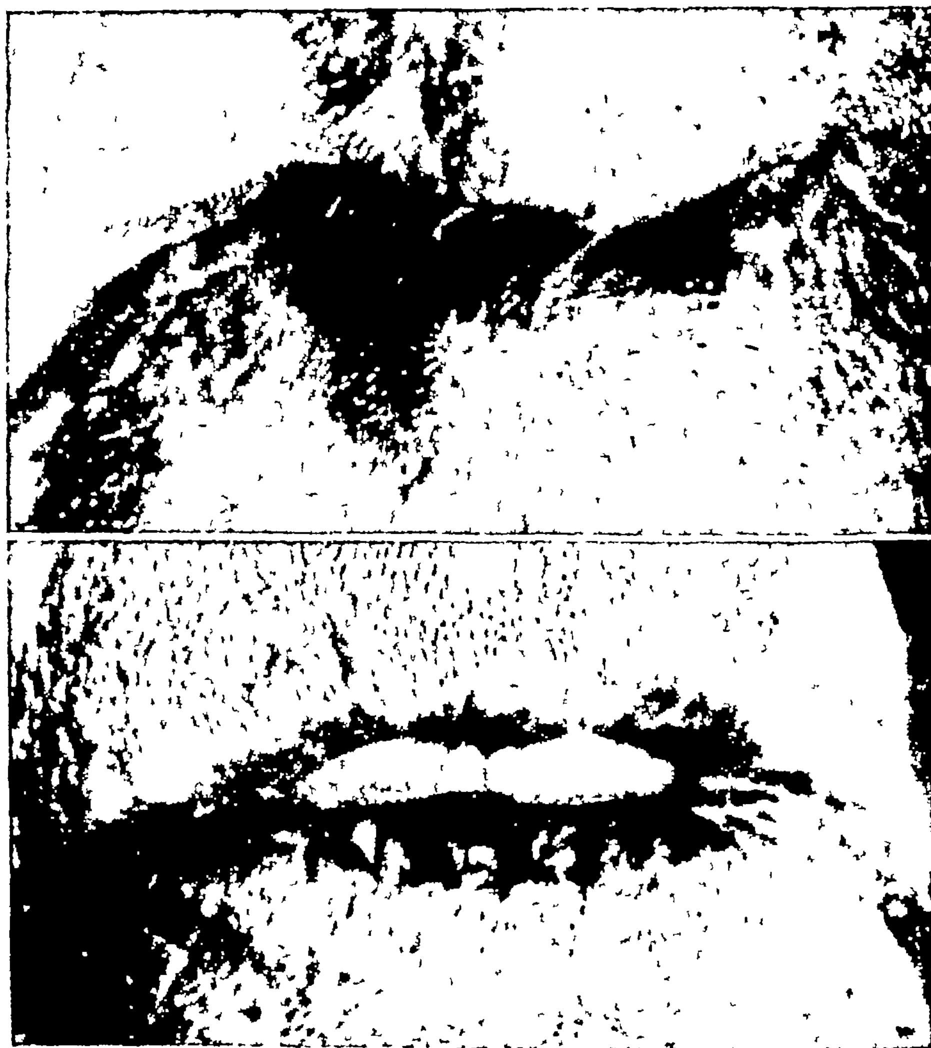


FIG 6 1 (*Upper*)—A simple keratosis without clinical signs of carcinoma. Excisional biopsy disclosed carcinomatous invasion

FIG 6 2 (*Lower*)—Large keratosis arising on an abnormal vermilion epithelium

Incidence

The lips are affected by carcinoma as frequently as are all other oral surfaces combined

1 The *lower lip* is the more common site (97 per cent) when compared with the upper lip The incidence is higher in men than in women

(10 1) In dry hot areas however where women are habitually exposed to the sun and wind without the protection of lipstick, as in some European countries the incidence is more equally divided The average age at onset of the disease is sixty years although carcinoma may occur in the hypersensitive mucous membranes of persons as young as sixteen years of age

2. The *upper lip* is less frequently affected (3 per cent) and the occurrence is more common in women (4 1)

Etiology

Certain inciting factors affect both upper and lower lips

1 The *actinic* (violet and ultraviolet) *rays of the sun* together with *wind* and *dryness* are the most common sources of irritation to the lower lip
2. *Dietary deficiencies* of both vitamins and proteins may lower the resistance of the mucous membrane and thus contribute to the formation of precancerous lesions as well as to carcinoma on both the upper and lower lip
3 *Systemic conditions* i e. constitutional variations such as skin pigmentation and hair coloring and of course syphilis may alter the resistance to irritation These must be considered as contributing factors.
4 *Smoking* is an etiologic factor in labial carcinoma There is little doubt as to the significance of the irritating effect of heat and persistent contact with cigarette paper and the pipestem on tissues of the lower lip

Histopathology

1 Labial carcinoma proves most frequently to be of the squamous-cell type. Ninety per cent are Grade I or II
2. A spindle-cell epidermoid type of carcinoma occurs rarely (less than 1 per cent) The epithelial cells particularly the altered basal cells can be seen to stream out into the stroma and are difficult to distinguish microscopically from fibrosarcoma. This is a spindle-cell metaplasia. The prognosis for this type of lesion is grave.
3. Microscopic study of a biopsy should report tumor type and grade In addition, following surgical excisions the report should state the extent of infiltration, vascular permeation, and adequacy of surgical margins.

Clinical Characteristics

The vermilion surface is the site for the greatest percentage of carcinomas of the lower lip Although the lingual or moist surfaces are sub-

jected to irritation by sharp jagged, or protruding teeth, carcinoma is rarely seen here The commissures commonly show signs of linear cheilitis from long-standing dietary deficiencies and/or drooling caused by overclosure This inflammatory fissuring over a long period of time may contribute to carcinoma



FIG 6 3 (*Upper*)—Early carcinoma on the vermilion surface of the right side of the lower lip arising in an abnormal mucous membrane showing both leukoplakia and keratoses

FIG. 6 4 (*Lower*)—Early carcinoma invading the cutaneous border, with characteristic keratotic formation and an elevated rolled margin

Lower Lip The lesion in the early stage may appear to be only a blister scale or crust, however these signs of growth may change quickly into an exophytic or endophytic type of carcinoma

EXOPHYTIC This type of growth appears either as a papillary or as a smooth dome-shaped elevated, round or oval nodule on the vermilion surface If papillary it has an irregular, warty rough surface and often is covered by a crust Both types remain localized for a long period of



FIG. 6 5—Superficial carcinoma on right side of lower lip associated with leukoplakia, keratoses and abnormal mucous membrane and vermilion epithelium



FIG 6 6—Villous exophytic carcinoma arising on abnormal atrophic vermilion epithelium

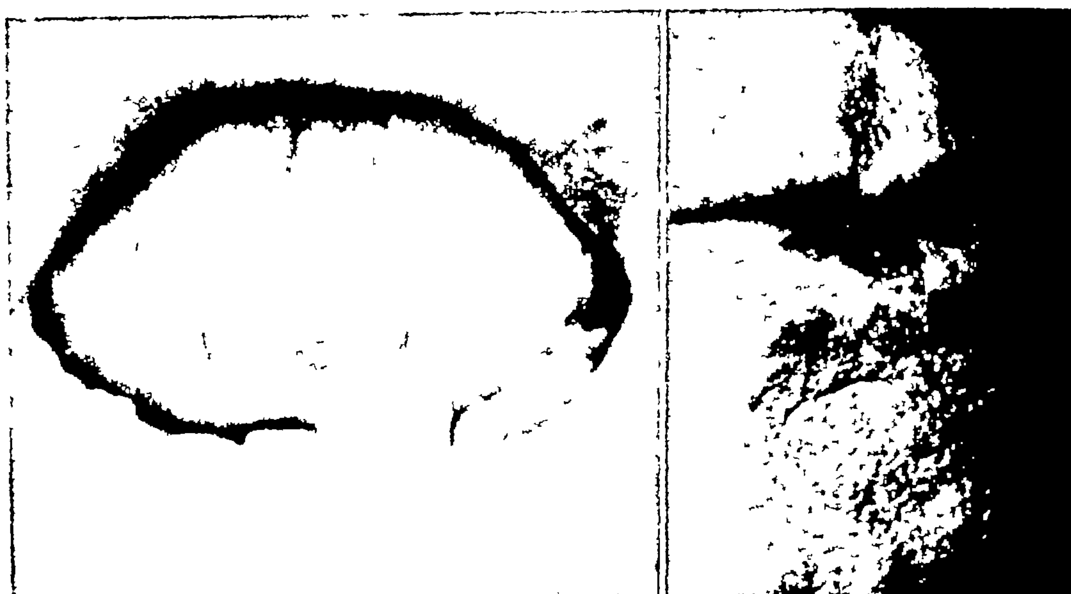


FIG. 6 7 (*Left*)—Carcinoma arising in scar tissue from a severe burn sustained fifteen years previously

FIG. 6 8 (*Right*)—Endophytic carcinoma arising in dense scar tissue sustained from a burn

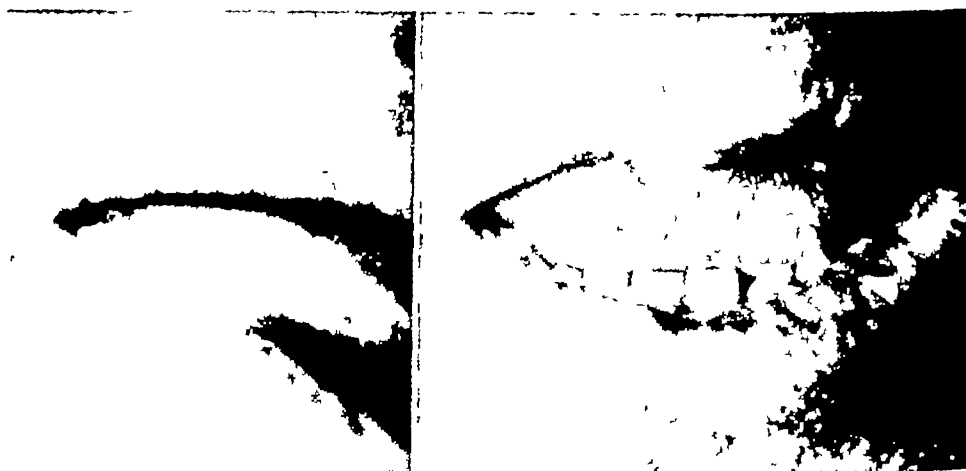


FIG. 6 9 (*Left*)—Carcinoma arising in dense contracted scar sustained from a scald many years previously

FIG. 6 10 (*Right*)—Classical crateriform carcinoma with signs of early invasion

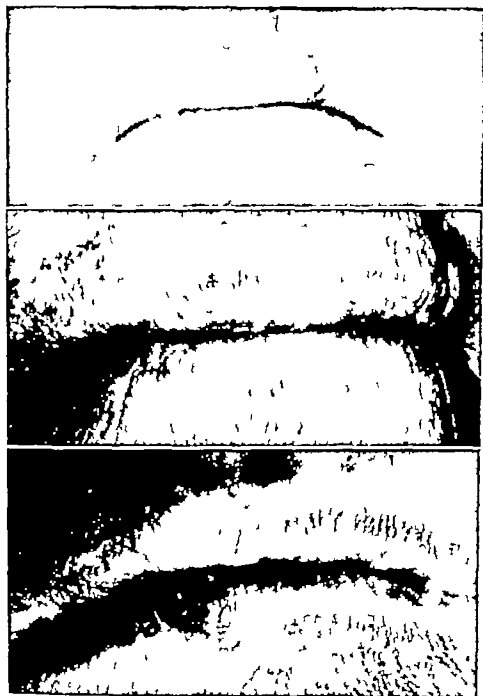


FIG 6 11 (*Upper*)—Early carcinoma arising on the border with equal invasion of vermilion epithelium and skin The lesion is partially ulcerated, and invasion is shown by the pearly rolled margin

FIG 6 12 (*Center*)—Minute carcinoma arising in vermilion border with early signs of invasion

FIG 6 13 (*Lower*)—Carcinoma arising in the vermilion area with invasion of the skin. Removal of keratotic covering disclosed a typical crateriform ulcer



Fig. 6-14 (*Upper*)—Superficial carcinoma with granular appearance associated with a precancerous keratosis.

Fig. 6-15 (*Lower*)—Superficial carcinomatous ulceration partially covered by leukoplakia.

time and ulceration takes place late or following injury Ordinarily these lesions become quite large before metastases occur

ENDOPHYTIC. This type of growth first appears as an indurated thickening in the mucous membrane Ulceration appears early and is characteristically crateriform.



FIG 6 16 (*Upper*)—Minute craterlike carcinoma with minimal invasion

FIG 6 17 (*Lower*)—Early superficial carcinoma arising in a vermilion epithelium badly scarred from overexposure to the elements

The crater may be covered by a crust, while the margin is raised, rolled, and pearly suggesting invasion Many variations of this classic are observed These growths are most aggressive locally and metastases are more frequent than in the exophytic type.

Upper Lip Tumors on the upper lip have the same clinical characteristics, but the endophytic types are much more common. Growth and

FIG. 6.18—Endophytic carcinoma covered by leukoplakia

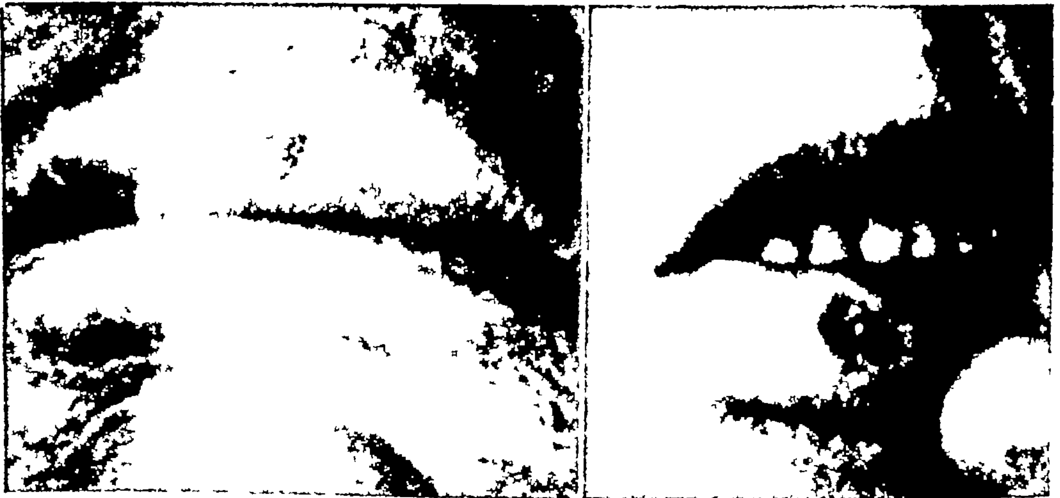


FIG. 6.19 (*Left*)—Ulcerating carcinoma arising on the vermilion surface, with secondary invasion across the cutaneous border. The distortion of the lip is prominently demonstrated.

FIG. 6.20 (*Right*)—Endophytic carcinoma with crateriform shape and rolled margin suggesting invasion of muscle.



FIG 6 21 (*Left*)—Endophytic carcinoma with a fine granular ulceration and a classical appearance of marginal invasion

FIG 6 22 (*Right*)—Irregular carcinomatous ulcer distorting normal surface contour



FIG. 6 23—Extensive superficial carcinoma arising in altered epithelium with leukoplakia.

invasion take place more rapidly, and metastases occur earlier and more frequently than in the lower lip

Metastatic Involvement of Cervical Nodes, Secondary to Carcinoma of the Lip Such involvement is relatively rare, as compared with intraoral carcinomas, and yet it is significantly greater than for carcinoma of the skin In the authors' series, 8 6 per cent had positive adenopathy on



FIG 6 24 (*Upper*)—Nodular carcinoma with early invasion of muscle

FIG 6 25 (*Lower*)—Advanced carcinoma with a fine granular ulceration and classical rolled margin

the first examination, and 4 3 per cent developed metastasis subsequent to the treatment of the primary growth The reports of cervical metastasis vary greatly, for palpable metastases are reported up to three times these percentages Carcinoma of the upper lip definitely metastasizes more frequently with metastasis reported in up to 50 per cent of cases Prognosis is correspondingly worse

Enlargement of the lymph nodes may result from a metastatic tumor or secondary inflammation Nodes enlarged by inflammation are rather soft freely movable, and tender, and they ordinarily regress during the treatment of the primary lesion On the other hand, metastatic nodes are comparatively indurated, nontender, and, in later stages, adherent to the surrounding tissues. But it is possible that both processes are simul-

taneously present and that enlargement of cervical nodes may be due to metastatic involvement as well as to inflammation. In all cases of adenopathy biopsy by excision or aspiration should be promptly performed

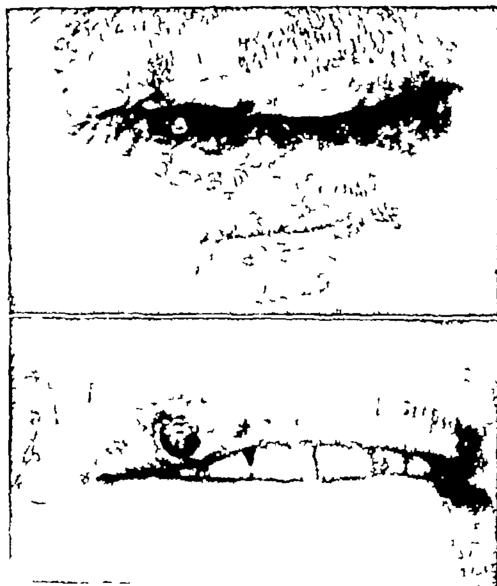


FIG. 6 26 (*Upper*)—Endophytic carcinoma with fissure formation and invasion of muscle.

FIG 6 27 (*Lower*)—Carcinoma appearing as ulcerated dome-shaped lesion with invasion of muscle.

Metastases are more common to the facial (accessory) and submaxillary nodes than to the submental group Later in the disease the upper deep cervical nodes may become involved. Metastases from the upper lip to the accessory facial nodes as well as to the preauricular nodes are common before involvement of the deep jugular nodes

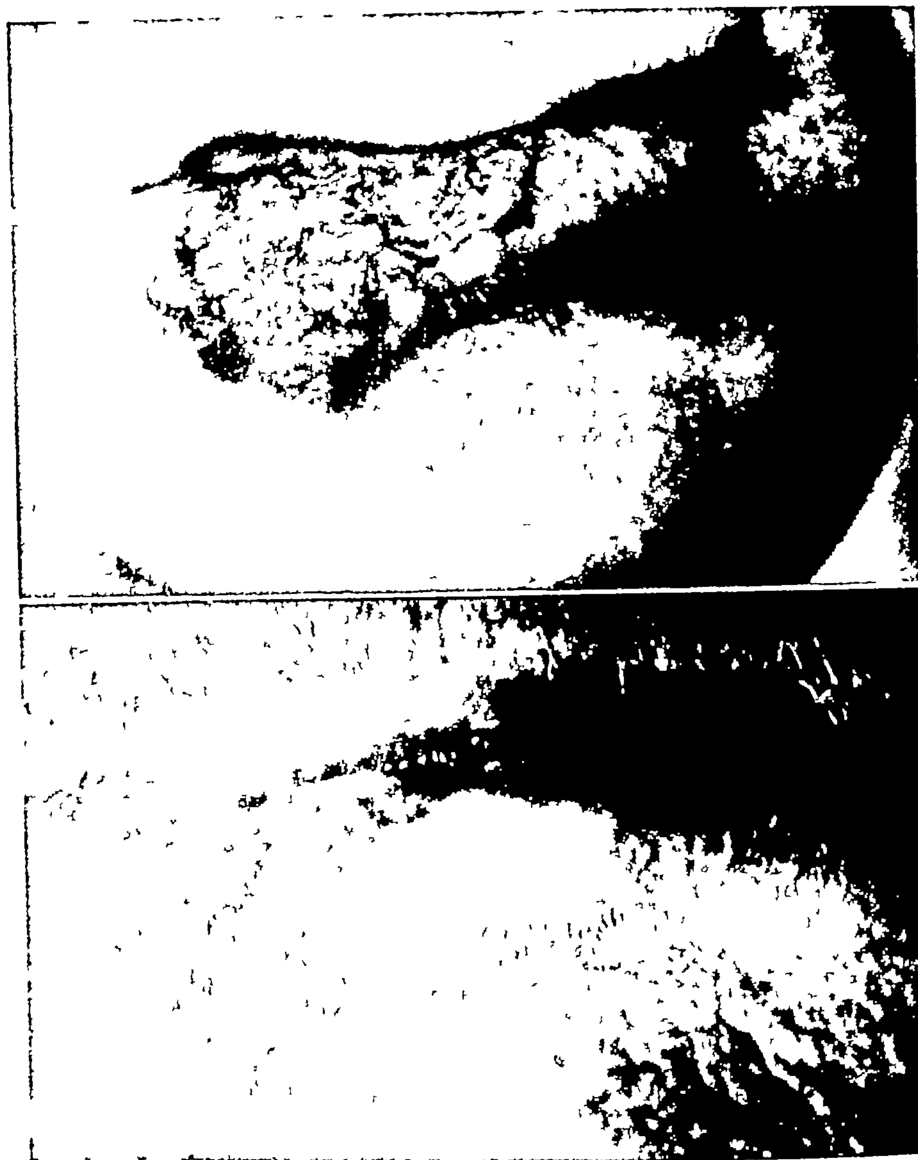


FIG. 6 28 (*Upper*)—Advanced carcinoma invading the full thickness of the lip Cervical lymph nodes were not enlarged at the time of treatment, but metastases developed subsequently

FIG 6 29 (*Lower*)—Advanced carcinoma arising on the vermilion surface with secondary invasion of skin and extensive infiltration of the full thickness of the lip and the labial commissure

Diagnosis

Any lesion which has persisted for more than a month should be considered as a possible carcinoma Any persistent lesion with flaking or crusting or any small ulcer or minute nodule which does not disappear in a few weeks is indicative of early carcinomatous changes Biopsy is



FIG 6 30 (*Upper*)—Bilateral simultaneous carcinomas are developing in an abnormal keratotic vermilion epithelium

FIG. 6 31 (*Lower*)—Multiple simultaneous carcinomas in an altered vermilion epithelium

necessary for a positive diagnosis and should be accomplished before treatment is begun

Treatment

Carcinoma of the lip is, potentially a fatal disease Immediate eradication of the primary growth is therefore necessary in order to reduce the danger of local spread of the process as well as involvement of cervical lymph nodes. Growths may be treated by one of several means, depend



FIG 6 32—Carcinoma of the upper and lower lips simultaneously, with ulceration and invasion

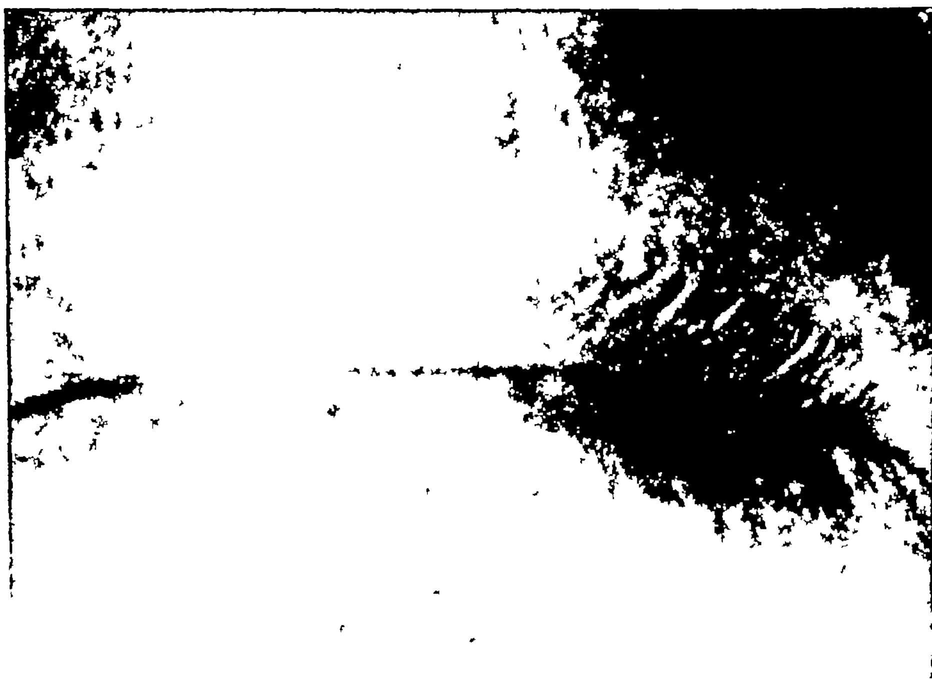


FIG 6 33—Early carcinoma of the skin invading the vermilion border The crateriform shape is classically illustrated



FIG. 6 34 (*Upper*)—Basal-cell carcinoma arising in the skin with secondary invasion of the vermilion epithelium and muscle

FIG 6 35 (*Lower*)—Carcinoma of the skin with invasion of the full thickness of the lip

ing on the type and extent of the disease, the condition of the patient, and the cosmetic end result

Irradiation

1 For small lesions, surface application of a radium plaque will produce a high rate of cure with minimal deformity

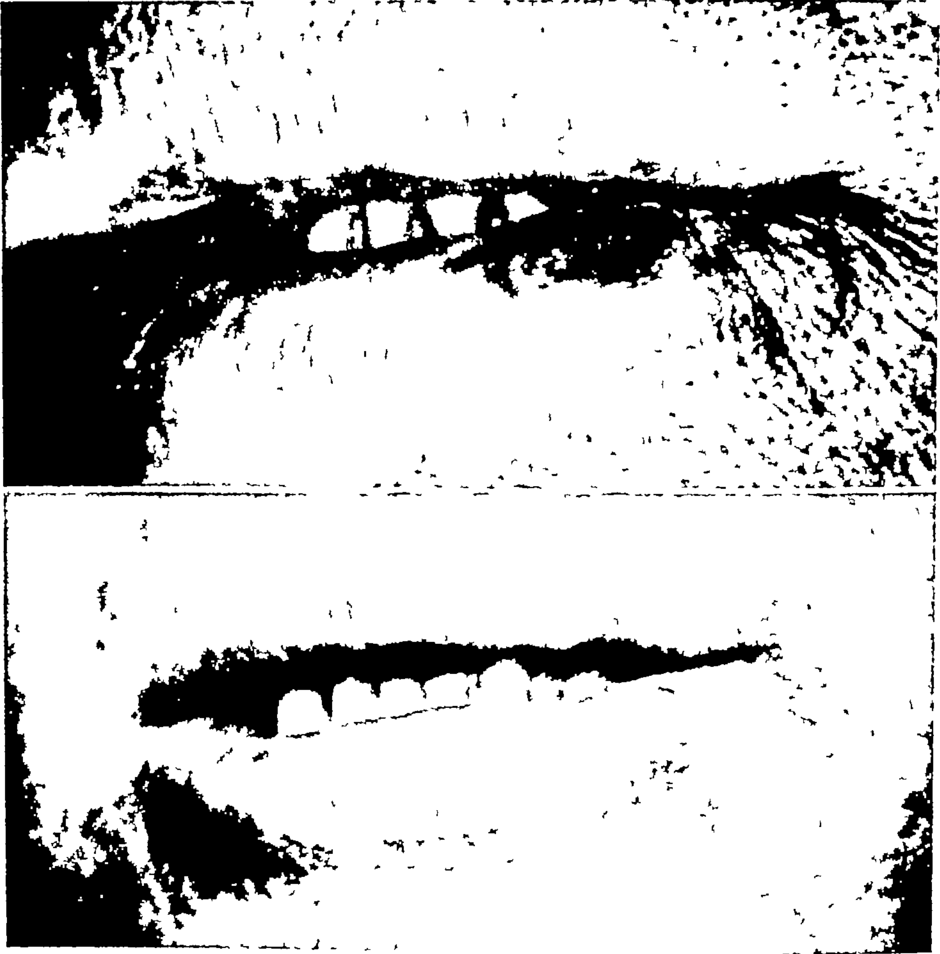


FIG 6 36 (*Upper*)—Superficial carcinoma with surface spread and relatively little invasion Surface radium application is indicated for this type

FIG. 6 37 (*Lower*)—End result twenty years after radium therapy as illustrated in Fig 6·36

2 Larger lesions which have invaded the substance of the lips may require interstitial radium An alternative method of radiation consists of multiple treatments with high-voltage roentgen rays

3 The minimum radiation dosage for either small or large lesions should be calculated for the delivery of 6000 tissue roentgens into the base of the tumor



Fig 6 38 (*Upper*)—Advanced keratotic type of carcinoma involving entire lower lip Superficial carcinoma arising in leukoplakia is best suited for radium therapy

Fig 6 39 (*Lower*)—End result, eighteen years after surface radium therapy on case illustrated in Fig 6 38

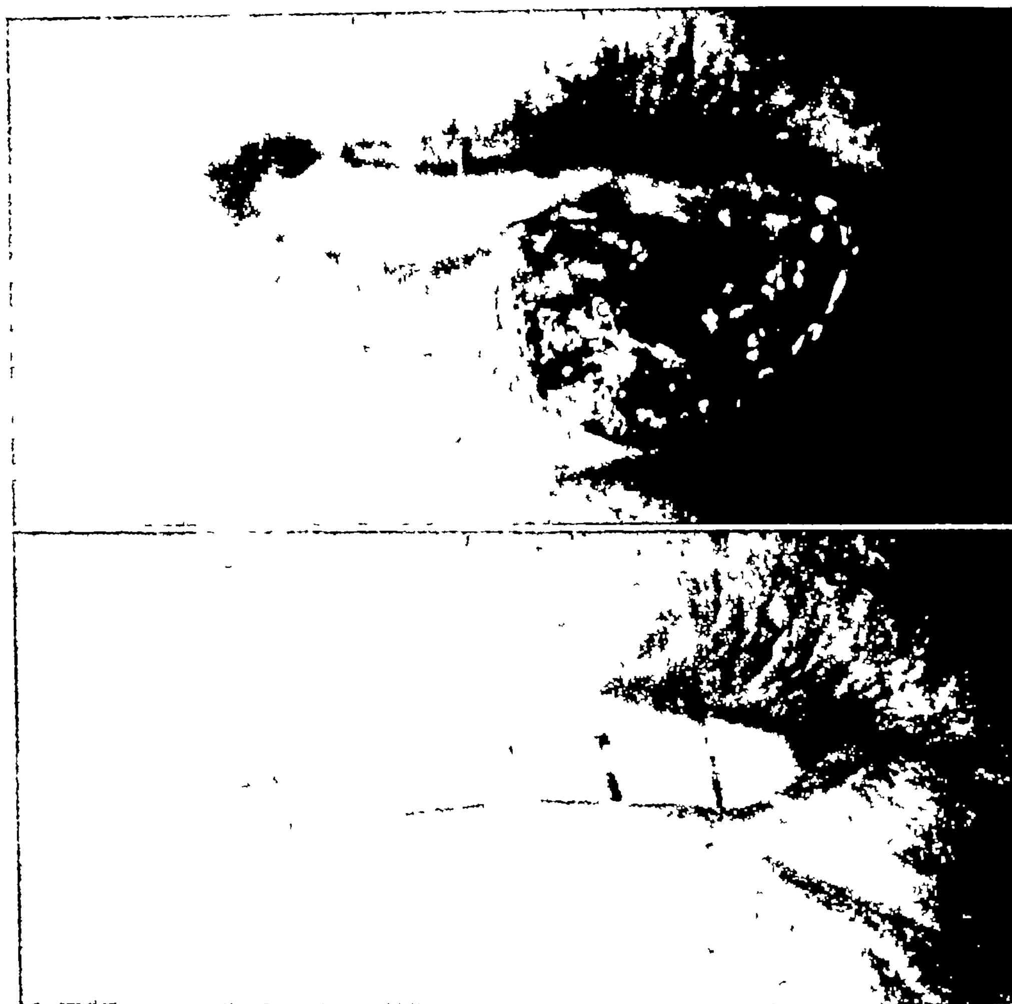


FIG 6 40 (*Upper*)—Advanced endophytic carcinoma involving half the lip Treatment with roentgen therapy or interstitial radium needles is indicated

FIG 6 41 (*Lower*)—End result (Fig 6 40), fourteen years after interstitial radium needles Cervical nodes were present at the time of treatment, and a radical neck dissection was performed after treatment of the primary lesion

Surgery Treatment by surgery will be successful if the lesion is completely excised The loss of substance of the lip resulting from surgery will have a more serious cosmetic effect than that produced by irradiation

1 Small lesions (1 0 cm) may be removed by a V-shaped excision
2 More advanced growths may be removed by a more extensive excision and will prove successful only if the wedge of tissue removed is extensive enough to include a margin of at least 1 0 cm beyond the clinical limits of the growth A good cosmetic result is essential and may be obtained by a plastic procedure incorporating the Estlander graft which makes use of a triangular flap from the upper lip When the entire substance of the lip must be removed down to the sub



FIG 6 42—Advanced carcinoma invading two-thirds of the lower lip with infection. Surgery is usually indicated for such extensive growths particularly when infection is present.



FIG 6 43—End result of case (Fig 6 42) ten years after radical excision of the lower lip and immediate plastic repair

mental process, extensive cheek flaps with or without Estlander graft, may be incorporated in the plastic repair The surgical judgment should be checked subsequently through microscopic examination of the tissue margins.

3. Recurrent lesions following roentgen and radium therapy are treated surgically
4. Clinically palpable cervical lymph nodes are treated as metastatic involvement by a radical neck dissection immediately following the treatment of the primary lesion In advanced cases where a primary

lesion is to be treated by surgery, and where cervical lymph nodes are involved, the primary lesion as well as the contents of the involved side of the neck are removed in continuity Reconstruction of the lower lip ordinarily is made at the same time Prophylactic neck dissections are not recommended

Prognosis

The prospect for cure of carcinoma of the lower lip (i e, five-year survival without recurrence) is much better than for other parts in the



FIG 6 44 (*Left*)—Advanced exophytic carcinoma infiltrating half of the lower lip Bulky growth with extensive infiltration is adaptable to radical surgery.
FIG 6 45 (*Right*)—End result of case (Fig 6 44), after radical excision of the lower lip and immediate plastic repair

mouth If metastases do not develop at any time, the rate of five-year cures should amount to at least 95 per cent Cases with positive cervical node involvement have a cure rate of approximately 75 per cent

Lesions of the upper lip are more aggressive and metastasize earlier, therefore the prognosis is not so favorable as for similar lesions on the lower lip

DIFFERENTIAL DIAGNOSIS

Since the primary problem in any lesion of the lips is the ruling out of nonmalignant or precancerous processes before a diagnosis of carcinoma is made, differential diagnosis is of the utmost importance The diagnostician must therefore be able to recognize the various other lesions commonly presented for examination

Precancerous Lesions

The term *precancerous* does not imply that the appearance of cancer is inevitable, but rather refers to a precursory lesion which is likely to



FIG 6 46 (*Upper*)—Recurrent carcinoma in scar tissue after electrodesiccation Cervical metastases were present in submental and submaxillary triangles

FIG 6 47 (*Center*)—Recurrent carcinoma is shown on the margin of scar produced by electrodesiccation. Cervical metastases were demonstrated.

FIG 6 48 (*Lower*)—Recurrent carcinoma involving full thickness of the lip in a scar resulting from a previous cauterization Electrodesiccation introduced infection with subsequent inflammation in the tumor-bearing area. Bilateral cervical metastases were demonstrated.

undergo cancerous transformation unless proper therapy is instituted There can be no doubt that carcinoma is preceded in a number of instances by the appearance of one or more of the so-called precancerous states However, the exact percentage of the relationship is still highly



FIG 6 49 (*Upper*)—Leukoplakia (smokers' patch) An irregular, advanced, hyperkeratotic plaque Microscopic study demonstrated precancerous dyskeratosis

FIG 6 50 (*Lower*)—Advanced leukoplakia in a patient with hypersensitive skin and vermilion epithelium Inciting factors overexposure to the elements and smoking

controversial In our experience, 50 per cent of all patients had preexisting lesions such as leukoplakia senile keratoses, or cheilitis—singly or combined

Leukoplakia This lesion is more frequently seen than any other precancerous condition It may be described as an abnormal reaction of the mucous membrane toward extraneous stimuli which under ordinary conditions would lead merely to a simple inflammation This susceptibility or response to irritation is so far unexplained The etiologic factors of

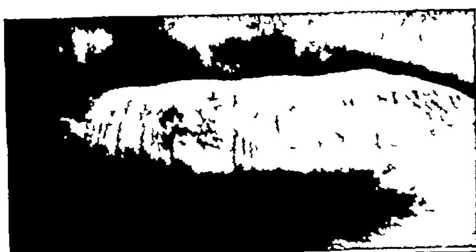






FIG. 6 51 (*Upper*)—Keratosis on the mucovermilion border

FIG 6 52 (*Center*)—Keratosis on a completely altered vermilion epithelium which had been deeply scarred by scalding fifteen years previously

FIG 6 53 (*Lower*)—Keratoses resulting from overexposure to the elements in a patient with hypersensitive skin and vermilion epithelium

leukoplakia are similar to those demonstrated for labial carcinoma They include exposure to the elements (sun and wind), chemical and thermal irritants (smoking, particularly the pipe), mechanical trauma (all injuries, especially the adherence of cigarette paper), and dental irritants (prominent, jagged, rough, or broken teeth) Not all persons exposed to one or more of these factors develop leukoplakia This leads to the assumption that an abnormal mucous membrane produced by a disturbed underlying metabolic process is probably an accessory before the fact in the development of leukoplakia

During the early, filmy stage of leukoplakia, conservative treatment is indicated The elimination of the known irritants conducive to the development of the lesion is necessary Improvement in digestion, particularly in assimilation of protein, together with vitamin therapy, is also indicated The advanced localized leukoplakia lesions are removed surgically Advanced diffuse involvement may require removal of the entire vermilion surface of the lip Plastic reconstruction is possible by undermining the mucous membrane on the lingual or inner surface of the lip and drawing it forward to the vermilion border so that it may serve as a new mucosal covering (cheiloplasty) The use of caustic substances, such as silver nitrate, or electrodesiccation is never justified in treating leukoplakia

Keratoses In etiology and histopathology, keratoses closely resemble leukoplakia Their appearance ranges from a scaling, somewhat crusted area to a hornified outgrowth Single keratoses are seen, but multiple lesions are the rule The characteristic sites are the vermilion surface and border of the lower lip, although infrequently they appear on the upper lip Their course is a repeated exfoliation of the crust, and cancerous changes are usually not present until the shedding process is accompanied by bleeding

In young persons, keratoses are likely to respond to the protection of the labial vermilion epithelium from the elements, and application of boric acid ointment or of other emollients is indicated Should these attentions fail to clear up the lesions in two weeks, excisional biopsy should be performed for diagnosis as well as for cure

Cheilitis This diffuse chronic inflammation of the vermilion epithelium usually affects young people It is most frequently observed in those whose skin and mucous membrane are hypersensitive to actinic rays and inclement weather As the process progresses, the inflammation is complicated by scaling keratoses, fissures, and even ulcers

Cheilitis is treated by the elimination of the known causes of the disease Nonirritating ointments should be applied, and any lesion which does not respond in two weeks should have excisional biopsy The removal of the involved portion, followed by plastic repair of the lip, is

indicated for the more extensive lesions Roentgen or radium therapy desiccation, and caustics are contraindicated

Inflammatory Lesions

Nonspecific Granuloma Among these lesions of the lip the most frequent are pyogenic granulomas They are characterized by exuberant

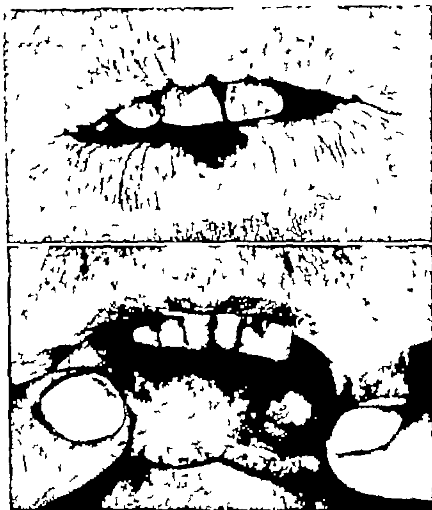


FIG 6 54 (*Upper*)—Chronic nonspecific granuloma showing exuberant granular tissue resulting from an injury

FIG. 6 55 (*Lower*)—Chronic nonspecific ulcer having a punched-out appearance as a result of injury from protruding lower teeth.

granulation tissue with or without ulceration of the overlying epithelium Their clinical course is persistent, and although they may heal spontaneously differentiation from hemangioma and mucosal warts is sometimes difficult. Microscopically besides the granulation tissue the epithelium when present may show a pseudoepitheliomatous hyperplasia. Treatment is usually accompanied by an excisional biopsy

Cheilitis Granulomatosa This idiopathic enlargement usually involves the lips particularly the lower lip, the lower half of the cheeks, and the tip of the tongue This type of granulomatous reaction is thought to be related to an endogenous chemical allergy and is usually, though not exclusively associated with a drug eruption The histologic structures suggest Boeck's sarcoid, but sarcoidosis and other known causes of chronic granulomas of tuberculoid structure are evidently not responsible for these changes Three inflammatory abnormalities are responsible for the labial enlargement (1) a pericapillary cell immigration, (2) a



FIG 6 56–Pyogenic granuloma simulating a hemangioma

nodular sarcoid type of cell proliferation, (3) a diffuse edema with an increase of fibroblasts

The clinical course usually starts with an abrupt edematous swelling of the lips, or of the lower lip alone The characteristic enlargement and eversion of the lower lip, with the fullness of the lower cheeks, result in a heaviness of the lower part of the face suggestive of facial palsy The disease persists for several weeks, with periods thereafter of incomplete regression

The treatment is directed toward careful diagnosis and the elimination of the offending drug

Ascher's Syndrome The etiology of this condition, which is characterized by a marked swelling of the lips and upper eyelids, is not known The histologic findings are a connective-tissue increase in the lips and, in the more advanced cases, a reticulofibrocystic change in the glands with varying degrees of glandular hyperplasia The upper lid contains masses of yellow tissue which appear to be prolapsed orbital fat but microscopically are seen to be lacrimal gland substance, with perigland-

ular granulomatous response around the dilated salivary and mucous ducts of the lips

The clinical sign is an ectropion of both lips although the upper lip is more often involved and usually the process there is more extensive.



FIG 6 57 (*Upper*)—Chancre A primary lesion of syphilis which simulates the classic craterlike lesion of cancer but is without induration

FIG. 6 58 (*Lower*)—Chancre A primary syphilitic lesion with the characteristic granulation tissue covered with slough.

An associated varying degree of edema of the upper eyelids and blepharochalasis are always present.

The treatment, when indicated, is the surgical removal of the glandular hypertrophies and a plastic repair

Double Lip This anomaly either is present at birth or appears in early childhood The etiology is unknown. The condition may or may not be a feature of Ascher s syndrome The microscopic findings are similar to those of Ascher s syndrome.

The appearance is that of an enlargement of the upper lip The lip can be divided anatomically into external vermilion and internal buccal portions which meet at the normal line of the closure of the mouth with diffuse swelling A furrow along the vermilion margin causes an enlarged buccal portion to project as an extra fold, and in this way a double-lip appearance is produced

Angular Cheilosis This nonspecific inflammation is characterized by fissures and frequently by granular tissue in the commissures Numerous etiologic components exist, including deficiencies of riboflavin, of pyridoxine hydrochloride, and/or others of the B-complex group Lack of free hydrochloric acid in the stomach, low serum iron, and a faulty absorption of proteins may also contribute to the condition Angular cheilosis is synonymous with perlèche

Tuberculous Ulcer This specific granuloma of the lips is rare When it is present, similar lesions can be demonstrated in other parts of the oral cavity and lungs They frequently have a punched-out shape, but in contrast to cancer, tuberculous sores are soft, tender, and inflamed. Microscopic examination will usually suggest the diagnosis, but animal inoculation and microbiological studies are definitive. General improvement of the oral hygiene will assist, but healing of these secondary lesions depends on the control of the pulmonary disease

Syphilitic Ulcer Chancre, the primary lesion of syphilis, is one of the specific granulomas appearing on the lips It is a well-circumscribed lesion, elevated, denuded and moderately firm Simultaneously with ulceration of the lip, the spirochetes spread by way of the lymphatics, and the regional lymph nodes invariably are involved. A dark-field examination and serologic tests are usually sufficient to establish the diagnosis After the syphilitic character of the ulcer has been conclusively established, localized therapy of the labial lesion is not required. Treatment of the constitutional disease should be instituted at once by one familiar with antiluetic therapy

Benign Tumors

Various types of benign tumors originating in the mucosal epithelium or in the connective tissue are observed on the lips

Papillomas The true squamous-cell papilloma does not appear so frequently on the lips as on the tongue and buccal mucosa, but when it is observed, it appears pedunculated, with a villouslike surface. The fibroepithelial papilloma is usually secondary to injury. It arises on a broad base, and the protuberance is covered by a smooth mucosal surface Both lesions are usually single The size varies from a few millimeters to a centimeter or more Microscopic examination of the true papilloma reveals a distinctive pattern with acanthosis and papillomatosis of the

FIG. 6 59—Pseudo- or fibroepithelial papilloma covered with leukoplakia from irritation.

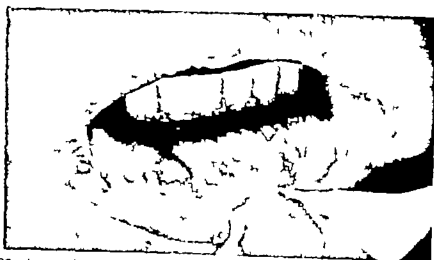


FIG 6 60—A pseudo- or fibroepithelial papilloma with a normal mucosal covering and consistency

mucosa The *pseudopapilloma* is characterized by proliferation of fibrous tissue with the overlying mucous membrane being altered by hyperkeratosis Adequate excision of these growths is required for diagnosis and treatment

Hemangiomas In infants these growths, which may be considered as tumors, are of congenital origin, in adults they are often acquired and usually result from trauma They are red or blue in color and vary from flat to slightly elevated, depending on whether they are superficial or deep Microscopically, they are classified as capillary, cavernous, or mixed



FIG 6 61—Mucosal wart (verruca vulgaris)

types (see Chap 7) Certain hemangiomas chiefly in children, show an alarming growth characteristic which necessitates prompt treatment with one of the following irradiation, excision, electrodesiccation, carbon dioxide snow, or various sclerosing agents

Mixed Tumors of Minor Salivary Gland Origin Though these tumors are common on the lips their site of origin is generally on the lingual surface and gingivolabial sulcus Clinically, the majority of these tumors may be described as firm spherical nodules which are freely movable in surrounding tissue and not attached to the mucous membranes This differential sign distinguishes them from the more common mucus-retention cyst For a complete description, see Chapter 11

Cystadenoma A rare but well-differentiated type of salivary tumor, the cystadenoma retains much of its secretory activity Microscopically, the cyst structure has numerous papillary processes, the epithelial lining is usually columnar but mucus-secreting cells are present. Surgical ex-

cision with an adequate zone of normal tissue is the recommended treatment.

Keratoacanthoma More commonly seen as a dermatologic lesion on the skin of the face or dorsum of the hands this tumor is rarely observed

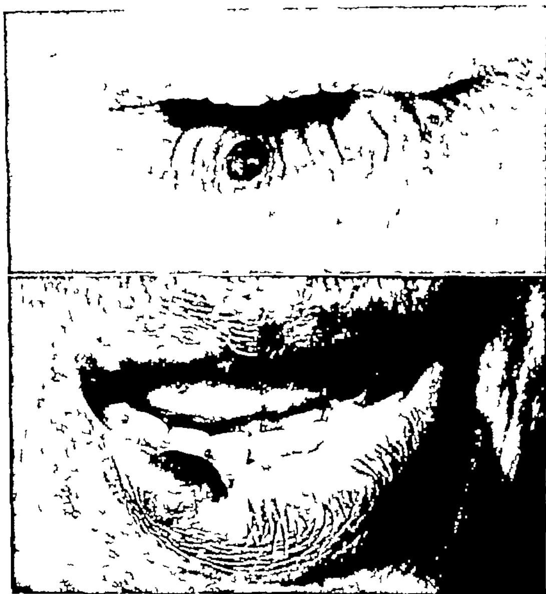


FIG 6 62 (*Upper*)—Cavernous hemangioma which is well circumscribed.
FIG. 6 63 (*Lower*)—Cavernous hemangioma which is compressible and invades surrounding tissue

on the lips and oral surfaces An illustration of this lesion is shown in Fig. 13 48

The histologic features are best studied under the low power magnification in order to bring out the differences between this benign lesion

and a low-grade squamous carcinoma In order to do this, at least half the lesion must be studied

Microscopically, the initial changes are multiple epidermal inclusion cysts with clumps and strands of invading acanthotic cells appearing around the periphery suggesting an early invasive margin beneath which, unlike cancer, is a polymorphous inflammatory exudate The cystic lining undergoes keratinization to form a central keratin core During this stage,



FIG 6 64—Interstitial hemangioma involving full thickness of the right upper lip

the growth impetus at the margins is lessened As this process continues, the cysts become confluent, the lesion assumes a flask-shaped contour, the surface opening enlarges and the central contents are extruded, leaving a residual scar

Clinically, these lesions are observed as single or multiple, the latter being most characteristic They vary from a verrucouslike papule, with rapid growth over a two- to three-month period, to a dome-shaped, pearly nodule which may ultimately ulcerate After rapid growth to a peak, they may remain stationary for a time and then undergo a spontaneous involution to leave a pitted atrophic scar

Mucus-retention Cysts Commonly found on the lips, these cysts arise following blockage of the duct from inflammation or trauma Surgical enucleation with capsule intact is the preferred treatment

FIG 6 65—Mucus retention cyst showing gelatinous contents through the thin mucosal covering.



FIG. 6 66—Mucus-retention cyst with papillomatous form and a leukoplakic response of mucosa from irritation

Other Malignant Tumors

The majority of malignant tumors of the lip are epidermoid carcinomas which are often preceded by keratoses and/or leukoplakia In contrast, other rare malignant tumors as a rule are not preceded by such precancerous lesions, except the melanoma, which is often preceded by the junctional nevus

Melanoma A melanoma appearing on the lip is a rare but truly cancerous neoplasm Although it arises from the type of cell normally producing pigment, not all melanomas are pigmented The term *melanoma* properly applies only to the malignant neoplasm, while the benign pigmented counterparts commonly found on the skin but sometimes found on the lip, are called *pigmented nevi* These appear more frequently on the tongue and gingiva Nevi are not always, but usually, pigmented, the color varying between brown, gray, and black

The primary lesion of melanoma rarely attains large size and may cause only minor local symptoms The ominous character is often first manifested by regional metastases which occur early and may even be widespread Any pigmented lesion associated with enlarged regional lymph nodes should immediately arouse suspicion The development of melanoma in a preexisting nevus is hastened by irritation, and is marked by an increase in size pigmentation, superficial ulceration, and bleeding The appearance of any one of these signs indicates cancerous transformation All pigmented lesions on the lip require excisional biopsy to establish diagnosis When this has been confirmed, wide excision of the scar resulting from biopsy, extending in depth beyond the fascia, is necessary. Furthermore radical block dissection of the cervical triangles on the side of the lesion should be performed whether or not palpable cervical nodes are demonstrated

Tumors of Nerve Origin The malignant schwannoma arising *de novo* or arising on the basis of von Recklinghausen's neurofibromatosis is a tumor of nerve origin They can be diagnosed only by histologic study

Reticuloendothelial-tissue Tumors Such a tumor on the lips is a local manifestation of a systemic leukemia a lymphosarcoma, a reticulum-cell sarcoma, or Hodgkin's disease In the absence of a known diagnosis, biopsy is justified These lesions usually regress significantly under adequate roentgen therapy The oral manifestations often include regional lymphadenopathy

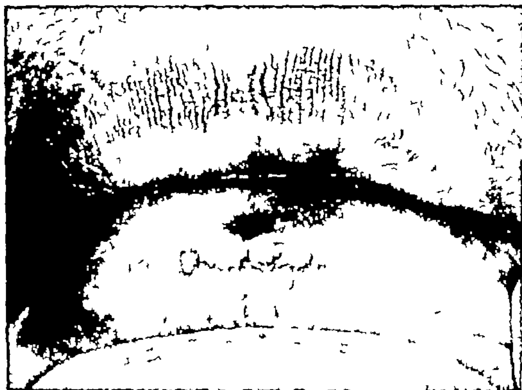


FIG 6 67—Pseudomelanosis secondary to hemosiderin deposit following trauma

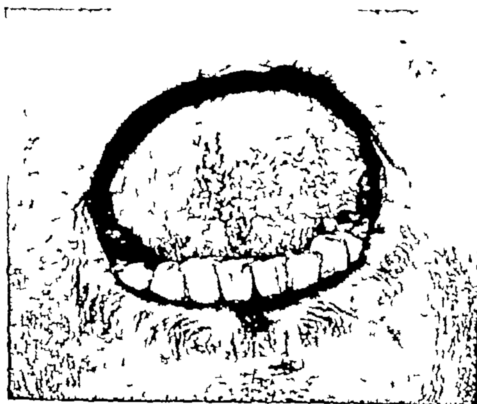


FIG 6 68—Pigmented nevus, or mole, benign.



Fig. 6 69—Congenital melanosis associated with multiple polyposis of the gastrointestinal tract

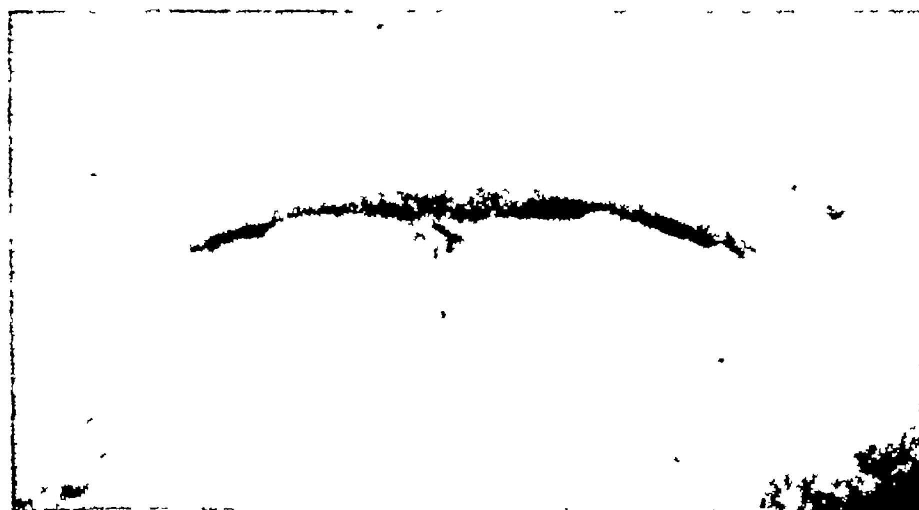


Fig. 6 70—Melanoma with a nodular surface suggesting activity and induration on palpation



FIG. 6 71—Leukemic infiltrate simulating a chronic granuloma with associated adenopathy in submaxillary triangle



FIG. 6 72—Leukemic infiltrate simulating herpes simplex.

READING REFERENCES

BERNIER, J L, and M L CLARK "Squamous cell carcinoma of the lip critical statistical and morphological analysis of 835 cases," *Military Surgeon* **109**. 379–405 (1951)

CROSS, J E, E GURALNICK, and E M DALAND "Carcinoma of the lips a review of 563 case records of carcinoma of the lips at the Pondville Hospital," *Surg Gynecol Obstet* 87.153–162 (1948)

DEL REGATA, J A "Roentgen therapy of carcinoma of the lower lip," *Radiology* 51 499–508 (1948)

FINDLAY, G H "Idiopathic enlargements of the lips cheilitis granulomatosa, Ascher's syndrome and double lip," *Brit J Dermatol* **66**·129–139 (1954)

JEGHERS, H, V A MCKUSICK, and K H KATZ "Generalized intestinal polyposis and melanin spots of the oral mucosa, lips and digits," *New Engl J Med* 241 993–1005 (1949)

KAZANJIAN V H "Estlander-Abbe operation in treating secondary harelip deformities and defects of upper lip resulting from cancer," *Plast & Reconstruct Surg* 2 307–325 (1947)

LANE, S L Oral cancer," *Oral Surg Oral Med Oral Pathol* 6 258–267 (1953)

SHARP G S H I WILLIAMS and R E PUGH, JR "Irradiation as the preferred treatment of cancer of the lip," *J Am Med Assoc* 142 698–707 (1950)

CHAPTER 7

LESIONS OF THE TONGUE

Lesions of the tongue are likely to cause local soreness and irritation in the initial stage The patient, therefore usually seeks consultative advice at a relatively early period in the disease. The diagnostician should be suspicious indeed, of any lesion of over two weeks duration Such lesions are to be classified as carcinoma until biopsy has proved otherwise

APPLIED ANATOMY

The tongue is a freely movable vascular and muscular organ located in the floor of the mouth. It is an important accessory to the functions of mastication deglutition and speech The free surfaces are covered by mucous membrane The *tip* is the most movable portion, and its range of motion is dependent upon the frenum Lesions involving the frenum cause soreness early in the course of the disease. The *base* is the tongue s least movable portion It is attached to the hyoid bone and epiglottis and to the anterior portion of the mandible by the fascia and the genioglossus muscles. Symptomatology occurs later in this location when extensive invasion causes painful deglutition or alterations of speech The nodules of lymphoid tissue covered with epithelium on the posterior surface of the base are referred to as the lingual tonsil. Carcinoma in this area is more commonly of the undifferentiated type, in contrast to the histologic grade of squamous-cell carcinomas appearing elsewhere on the tongue The *dorsum* has a convex surface covered with a special epithelium bearing several types of papillae It is grooved by the median raphe, which divides the tongue into halves This sulcus ends at the foramen cecum the orifice of the obliterated thyroglossal duct. The *sides* are covered by mucous membrane without papillae and are the most common sites for carcinoma. The undersurface is covered with a thinner mucosa and is an area frequently overlooked in the initial examination

The *mucosa* on the anterior two-thirds of the dorsum and the sides is closely adherent to and interdigitates with, the fascia of the underlying

muscle On the base and undersurface is a submucosa of loose connective tissue separating the mucosa from the underlying muscle

The *deep lymphatics* of the tongue decussate widely The lymph channels from the tip drain into the submental and submaxillary lymph nodes, the remaining area of the tongue is drained by the lymphatics accompanying the lingual vein This latter group of lymphatics terminates in the lingual, submaxillary, and deep cervical lymph nodes (the jugular chain) Intercommunication among the various groups is free, and frequently there is distribution of these structures to the opposite side of the neck Clinically, however, the incidence of contralateral metastases is less than 10 per cent in the early lesions In the late stages of untreated, or inadequately treated, cases the incidence is much higher

CARCINOMA OF THE TONGUE

Carcinoma of the tongue is a major challenge to the diagnostician and the surgeon The surgeon not only should be familiar with the earliest clinical characteristics—the most diversified shown by any of the intraoral cancers—but should also be adept in all the modalities employed in treatment

Incidence

Squamous carcinoma of the tongue comprises approximately 40 per cent of all such tumors in the oral cavity Its prevalence is greater among men (about 80 per cent) than among women The disease rarely appears in persons who have not reached the fourth decade of life, the average age of patients when detected being fifty-three years According to the site of origin, the greatest number of these lesions occurs along the sides of the tongue (65 per cent) Incidence on the tip, dorsum, and base is approximately equal (10 per cent)

Etiology

Cancerous changes may develop directly from chronic irritation, trauma, leukoplakia, or other precancerous conditions

1 *Oral sepsis* is a primary cause of cancer of the tongue Periodontal disease, dental decay, glossitis, and occasionally tonsillitis are the chronic infections which are most frequently associated with cancer In most instances, however, carcinogenesis is the cumulative result of several etiologic factors
2 *Dental irregularities*, such as jagged, broken, or rough teeth, ill-fitting or broken dentures, are seen in 50 per cent of the mouths with lingual

carcinoma Hereditary diastemas and/or the absence of teeth from the dental arch present irregularities of contour which seem to have a positional relationship to certain lingual cancers

3. *Avitaminosis B* may have a relationship to cancer of the tongue It is manifested by degenerative changes in the mucous membranes the most prominent of which is atrophy of papillae with a resulting bald, smooth dorsal surface A frequent extraoral manifestation of avitamin



FIG 7 1 (*Left*)—Minute superficial carcinoma appearing as a nodule with slightly elevated, rolled margin

FIG 7 2 (*Right*)—Superficial carcinoma, triangular and granulomatouslike although it is indurated on palpation.

osis-B is perleche or angular cheilosis although in this cutaneous disease the relationship to carcinoma is not impressive

4. *Trauma* of a chronic nature rather than a single injury is most frequently related to lingual carcinoma.
5. *Protein deficiencies* resulting from either poor dietary selection or loss of capacity to assimilate proteins will produce mucous membrane abnormalities similar to those of the avitaminoses The relationship to the incidence of carcinoma on the tongue is clinically impressive
6. *Syphilis* either present or past, is associated with 10 to 15 per cent of cases Syphilitic glossitis and leukoplakia are closely associated with carcinoma
7. *Tobacco* is difficult to evaluate as a cause but the pipe-smoking and tobacco-chewing habits are prominent in many case histories



FIG 7 3 (*Upper*)—Small papillary carcinoma with a papillomatous formation and only slight induration around the base

FIG 7 4 (*Lower*)—Small papillary carcinoma with a villouslike, slightly ulcerated surface The induration distinguishes it from a benign lesion

FIG 7 5—Early carcinoma simulating a verruca, but the indurated base is pathognomonic.



FIG 7 6—Carcinomatous nodule arising in a diffuse leukoplakic area The posterior rolled margin is definitely indurated



Fig 7 7—Leukoplakic type of papillary carcinoma with wide surface involvement and little invasion at depth The lingual mucosa has both atrophic and hyperkeratotic changes

Fig 7 8—Same case as in Fig 7 7, showing in greater detail the atrophic and hyperkeratotic changes

Histopathology

Lingual Carcinoma In an overwhelming majority of cases (98 per cent) lingual carcinoma is of the squamous variety In the anterior part of the tongue, the lesions are of lower grade than those in the base. Microscopically the anterior lesions show excessive keratinization sim ilar to that in lesions arising in the lip The lesions in the base of the tongue are frequently less differentiated and show less keratinization



FIG 7 9—Carcinoma arising in an area of irregular scarring and leukoplakia following long-standing irritation

Another term for this less-differentiated type is *transitional-cell car cinoma.*

Adenocarcinoma A rare condition is adenocarcinoma of the sero-mucinous glands of the tongue. Tumors of this type are more fully discussed in Chap 11

Clinical Characteristics

The patient may first notice a local area of thickness or a plaque on the surface of the mobile portion of the tongue but the usual clinical appearance suggests a classification similar to that for the lip

Exophytic This type may be either papillary or nodular The papillary form presents an everting growth which spreads laterally along the covering membrane is irregular in surface contour and tends to invade deeper structures late rather than early Ulceration may appear early but this form seems related more to continued external irritation (trauma from dental irregularity) than to the growth potential of the tumor



FIG 7 10—Small leukoplakic type of carcinoma near the tip, associated with advanced, abnormal atrophic lingual mucous membrane



FIG 7 11—Fine granular superficial carcinomatous ulceration, with only slight invasion. Precancerous leukoplakia surrounds the lesion.



FIG 7 12 (*Upper*)—Small carcinoma associated with an advanced precancerous type of leukoplakia and luetic glossitis

FIG 7 13 (*Lower*)—Small, nonulcerating carcinomatous lesion simulating scar tissue except for the induration by palpation





FIG 7 14 (*Upper*)—Ulcerated carcinomatous lesion with a pearly rolled margin and induration on palpation.

FIG 7 15 (*Lower*)—Crateriform carcinomatous ulcer with a fine granular crater and a nodular rolled margin.

Hyperkeratosis of the surface, often overlying the cancer proper or at its periphery, may frequently be observed The nodular form is apparent clinically at an early stage of the disease Such lesions are elevated and may be dome-shaped Invasion of deeper structures is minimal Induration, characteristic of cancer, is found in the elevated portion

Endophytic (Ulcerating) This is the most common type of lingual carcinoma It appears as a sore or small ulcer which may be tender, the



FIG 7 16—Carcinomatous ulceration simulating an inflammatory process The pathognomonic sign of induration was demonstrated on palpation

specific symptoms will vary, depending on location, trauma, and the severity of inflammatory reaction due to secondary infection Characteristically, the growth is a craterlike ulcer surrounded by an indurated, rolled border This induration of margins, which is invariably demonstrated, results from the invasion of surrounding tissues The indurated type of carcinoma is more aggressive than the papillary or nodular forms

Cervical Node Metastases This condition occurs in almost direct proportion to the size, duration, and microscopic grade of the primary lesion The incidence of metastases at the time of the first examination ranges from 40 to 55 per cent, and an additional 10 to 25 per cent of cases will later develop metastatic cervical nodes

Diagnosis

Early painless lesions first noted by the patient as a thickness or plaque, may not be readily visible but may at this stage be demonstrated



Fig 7 17 (*Upper*)—Superficial carcinomatous ulceration demonstrating the nodular invasive margin.

Fig 7 18 (*Lower*)—Carcinomatous ulceration associated with atrophic and leukoplakic mucous membranes as well as gross oral sepsis and rough jagged teeth.



FIG 7 19 (*Upper*)—Ulcerous carcinoma with an irregular and fissured surface associated with an abnormal atrophic and hyperplastic type of mucous membrane

FIG 7 20 (*Lower*)—Ulcerous carcinoma with extensive invasion of the side and base of the tongue as well as of the floor of the mouth.

by careful palpation. Usually, on the first examination a lesion—papillary nodular or ulcerated—can be seen, and the patient will complain of subjective symptoms such as pain or difficulty in deglutition Because it is characteristic for lingual carcinoma to disseminate rapidly every thickening or minute ulcer must be held in suspicion until biopsy proves that it is harmless Any carcinoma of the tongue is capable of early metastasis, but the incidence of secondary involvement rises sharply in proportion to the size of the lesion Early lesions as small as 3 mm have given rise to metastasis within a few weeks after onset of initial symp-



FIG 7 21—Advanced, evertive carcinoma associated with an abnormal hyper keratotic type of mucous membrane

toms. Infrequently enlargement of cervical lymph nodes occurs before the patient is aware of the lesion and therefore cervical metastasis is occasionally the presenting symptom.

A definitive diagnosis is a prerequisite of treatment. This can be ar rived at only by microscopic examination of tissue. A Wassermann test is advisable but a positive Wassermann test does not justify delaying the biopsy procedure

Treatment

In dealing with this highly aggressive disease the best results have been obtained by an integrated yet flexible plan of treatment Depending on the findings in the individual case the use of surgery roentgen therapy interstitial radiation, or a combination of these methods may be ad vised The skill of the surgeon or the radiologist, it must be noted will be of little avail unless lingual lesions are recognized while still in an early stage

Prophylactic Oral Hygiene This is essential in clearing up infection and inflammation adjacent to the tumor bearing area Therefore careful



FIG 7 22 (*Upper*)—Advanced carcinoma involving the midportion of the tongue and early invasion of the floor of the mouth

FIG 7 23 (*Lower*)—Ulcerous carcinoma involving the posterior third of the side of the tongue, associated with an abnormal mucous membrane characterized by hyperkeratosis, atrophy, and geographic features.



FIG. 7 24 (*Upper*)—Advanced, ulcerous carcinoma involving the posterior third of the side of the tongue, with early invasion of the anterior tonsillar pillar and floor of the mouth

FIG. 7 25 (*Lower*)—Advanced carcinoma of the side and base of the tongue, with secondary invasion of the anterior tonsillar pillar floor of the mouth, and mandible.

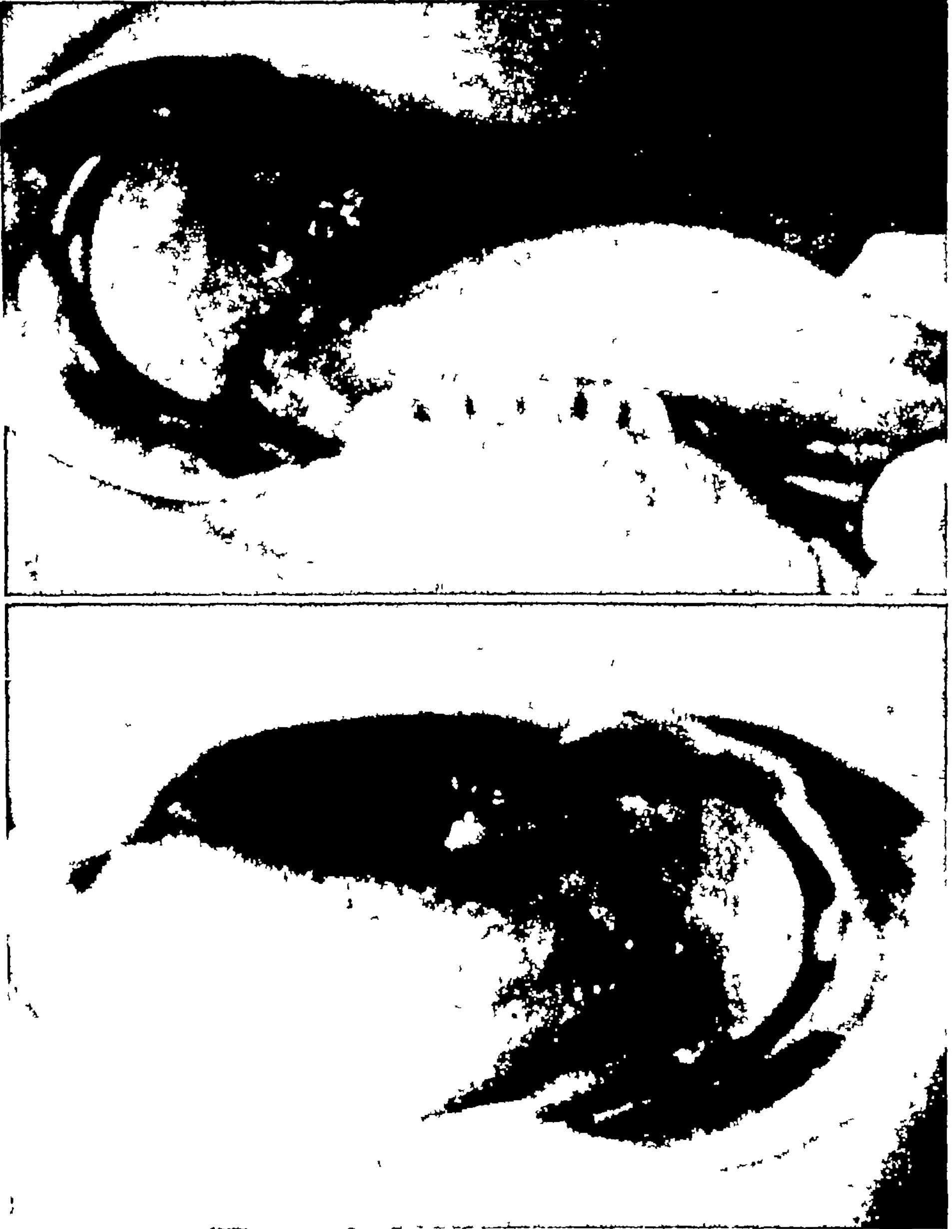


FIG 7 26 (*Upper*)—Small ulcerous carcinoma in the lingual tonsil area involving the anterior tonsillar pillar, the tongue, and the floor of the mouth, equally

FIG 7 27 (*Lower*)—Slightly ulcerating nodular carcinoma in the lingual tonsillar area involving extensively the base of the tongue, the anterior tonsillar pillar, and tonsillar fossa

dental prophylaxis and scaling, with attention directed toward the round ing and smoothing of rough jagged teeth, is an advisable preliminary step in the preparation of the patient for therapy Cavities in teeth should be filled and retained roots removed Also teeth which obstruct the accurate application of the roentgen therapy cone must be extracted

High protein Diet Such a diet with additional vitamin B complex and vitamin C is advisable Whole protein and amino acid supplements

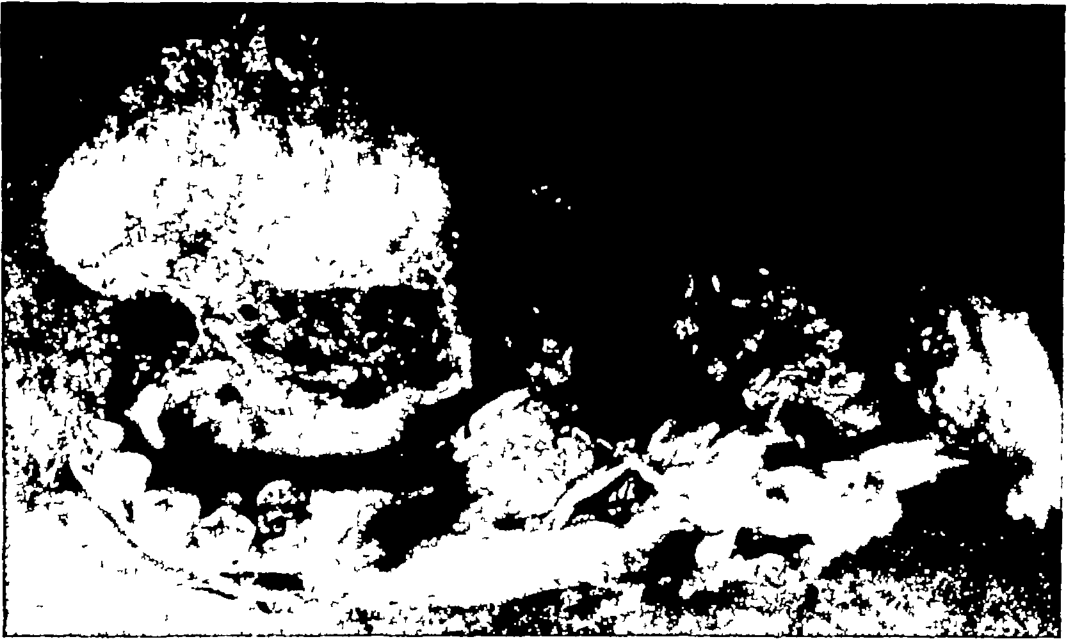


FIG 7 28—Nonulcerated, deeply invaded carcinoma involving the midportion of the posterior dorsum of the tongue

are particularly advantageous when radiation therapy is used. Chemotherapeutic agents are helpful in controlling inflammation.

Treatment of the Primary Growth Either surgery or radiation may be used in treatment.

SURGERY Successful operations may be performed on primary lesions less than 2 cm in diameter The excision should include at least 1.5 cm of normal tissue on all sides of the growth. Lesions on the tip may be removed by a large V-shaped incision. Those on the sides require at least a hemiglossectomy Surgical treatment is advised for large primary growths with or without cervical metastases Invasion of the floor of the mouth and anterior tonsillar pillar is a frequent finding in this group as well as metastatic involvement of the cervical nodes Provided that the



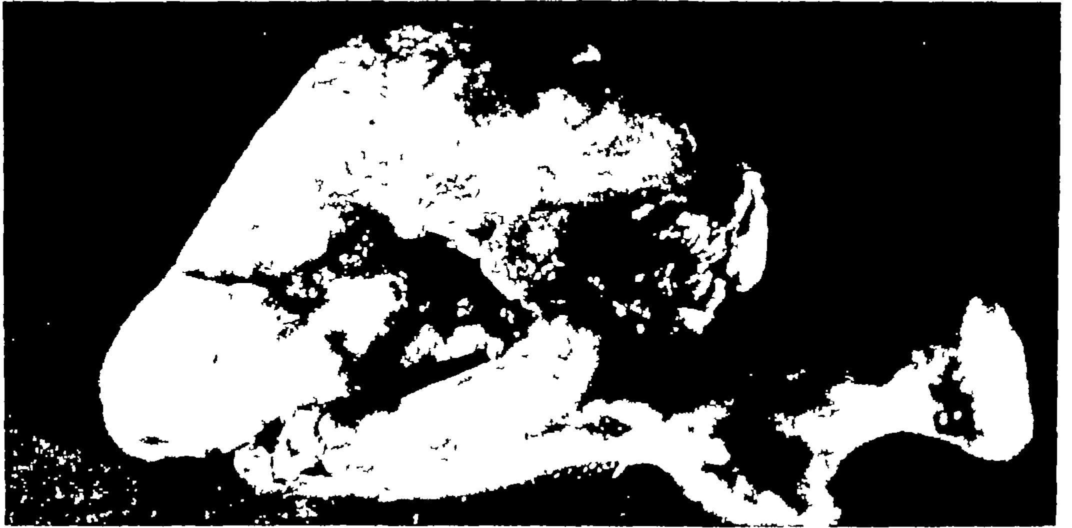


FIG 7 29 (*Upper*)—Gross surgical specimen of an ulcerous infiltrating carcinoma involving the tongue and floor of the mouth Hemiglossectomy combined with an ipsilateral resection was performed

FIG 7 30 (*Lower*)—Gross surgical specimen of an extensive infiltrating carcinoma involving half the tongue, floor of the mouth, and mandible



FIG 7 31—Gross surgical specimen of a carcinoma of the side and base of the tongue, including the mandible, half of the tongue, and contents of the neck.

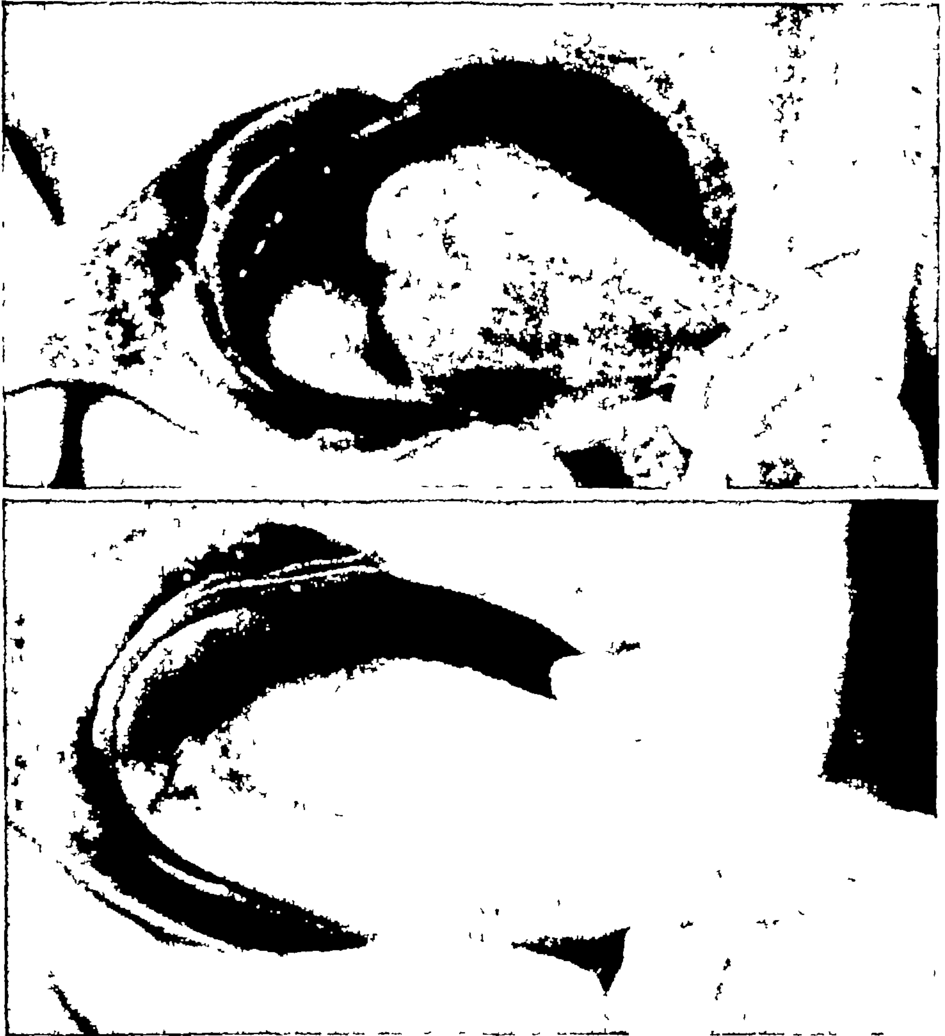


FIG 7 32 (*Upper*)—Invasive squamous-cell carcinoma, Grade III An ulceration is present on the right border of the tongue, posterior, measuring 3 × 3 × 3 cm Invasion occurs to the midline, and early invasion is present in the base of the tongue, but the floor of the mouth and the anterior tonsillar pillar are free The treatment was started with 200-kilovolt roentgen rays, a composite filter, with a half-value of 1 9 cu mm From Feb 8–21, 1941, a tumor-tissue dose of 1500 roentgens was delivered through a peroral cone 3 5 cm in diameter Two days after the last treatment, radium needles were inserted interstitially for an exposure of 850 mg hours, or a tumor-tissue dose of 3600 gamma roentgens throughout the mass The total tissue dose by the combined radiation was 5100 roentgens during a seventeen-day period Radical neck dissection was performed

FIG 7 33 (*Lower*)—End result (Fig 7 32) After thirteen years, patient is free of disease



FIG 7 34 (*Upper*)—Infiltrative squamous-cell carcinoma, Grade II The growth, 3 × 3 × 2 cm shown on the tongue posterior had invaded an area of the tongue about equal in size to the external part of the lesion and extending up to the junction of the anterior tonsillar pillar Floor of the mouth was free. Nodes were not palpable in the neck. Treatment started with 200-kilovolt roentgen rays composite filter and a half value layer of 1 9 cu mm From Mar 4–18 1943 a tumor tissue dose of 1500 roentgens was delivered through a peroral cone 3.5 cm in diameter On the day following the last treatment, radium needles were inserted interstitially for an exposure of 850 mg hours or a tumor tissue dose of 3600 gamma roentgens throughout the mass The total tissue dose by the combined radiation was 5100 roentgens during a seventeen-day period.

FIG 7 35 (*Lower*)—End result of case (Fig. 7 34) after five years. Patient remained well until 1948 when he died of coronary disease Post-mortem examination failed to show evidence of local recurrence or metastases



FIG 7 36 (*Upper*)—Invasive carcinoma of the tongue, Grade III An evertive ulceration, 4 × 4 × 3 cm Invasion of the tongue extends to the midline, and early invasion of the floor of the mouth is present A clinically positive metastatic node was present in the carotid triangle The treatment consisted of preliminary roentgen irradiation elsewhere, using 200 kilovolts, 0 5 cu mm and half-value layer of 1 0 cu mm during December, 1947 By the peroral route a tumor-tissue dose of 1500 roentgens and through the external portal a tumor-tissue dose of 4200 roentgens were given One month later, radium needles were inserted interstitially for an exposure of 1500 mg hours, or a tumor-tissue dose of 2800 gamma roentgens throughout the mass Treatment period of three months necessitated this large total dose

FIG 7 37 (*Lower*)—End result of case (Fig 7 36) The scar of the primary growth as it now appears Patient has remained free of the disease for seven years, and adenopathy has not developed in the neck.



FIG 7 38 (*Upper*)—Invasive squamous-cell carcinoma. An extensive ulceration is shown on the right posterior border of the tongue measuring 3 × 3 × 2 cm There was clinical evidence of invasion up to 2 cm in depth in the tongue, with early invasion of the anterior tonsillar pillar and the floor of the mouth. A clinically positive node was palpable in the carotid triangle Radiation therapy was administered despite the invasion beyond the limits of the tongue Treatment was started with 200-kilovolt roentgen rays, a composite filter with a half value layer of 1 9 cu mm From Apr 2–15 1943, a tumor tissue dose of 1650 roentgens was delivered through a peroral cone 3.5 cm in diameter The following day after the last treatment, radium needles were inserted interstitially for an exposure of 1150 mg hours, or a tumor tissue dose of 4900 gamma roentgens throughout the mass The total tissue dose by the combined radiation was 6550 roentgens during a sixteen-day period. Three weeks after the removal of the needles, the primary growth was apparently destroyed and a right radical neck dissection was performed. Two of the nodes showed microscopic evidence of cancer

FIG 7 39 (*Lower*)—End result (Fig. 7 38) after eleven years Note the functionally and aesthetically satisfactory dental restorations

condition is operable, excision of half the tongue, the floor of the mouth, and the mandible, combined with a radical neck dissection, may be the procedure of choice In this way a continuous mass of tissue which includes the primary lesion as well as the contents of the affected neck is removed



FIG 7 40—Same patient as shown in Figs 7 38 and 7 39, showing scars on the neck following radical neck dissection. No further evidence of disease has been demonstrated after eleven years.

RADIATION METHODS For early and moderately advanced primary growths which have not extended beyond the boundaries of the tongue, radiation methods are recommended Interstitial radiation with radium needles has proved most satisfactory for growths up to 4 0 cm in diameter Radium needles of low intensity are recommended, although radon seeds also are quite satisfactory The dosage of radiation must be planned in advance, and specific calculations made for each case A dose of 6000 tissue gamma roentgens is recommended

Roentgen therapy is applied through a peroral cone and is administered in fractional doses It is recommended for accessible and mod-

erately advanced lesions but cannot be depended on for delivering the total dose of radiation Under certain conditions it is desirable to ad minister the radiation in two forms in order that the interstitial dosage may not be too large Preliminary roentgen therapy may be counted on to deliver one-third to one-half the required tissue dosage prior to the use of the radium needles

In inoperable cases the primary growth is treated by roentgen therapy and subsequent implantation of radium needles. The initial treatment, however should be planned so as to be curative whenever possible as such a procedure is occasionally successful In extremely advanced cases only relatively small doses of palliative radiation should be applied in order to allow for later repetition

Treatment of Cervical Metastases This is primarily a surgical procedure Certain definite considerations distinguish this problem from carcinoma of the lip

1 The frequency of metastatic involvement on initial examination is estimated to be from 40 to 55 per cent, and the subsequent develop ment of metastatic nodes from 10 to 25 per cent The total number of patients with metastatic disease is generally reported to be from 60 to 80 per cent while untreated primary lesions that have been present one year or longer may have an incidence of metastasis as high as 90 per cent. Bilateral cervical involvement has been reported in approximately 18 per cent of cases with nearly a 50 per cent bi lateral involvement when the entire tip of the tongue is affected by the primary lesion
2. The clinically palpable node at the time of treatment of the primary lesion, must be considered prima facie evidence of metastasis and treated as such
3. Neck dissection may be done at the time of the excision of the primary lesion, but where radiation treatment has been employed, surgery may be deferred until two or three weeks after completion of the radiation treatment In advanced growths particularly those which have invaded beyond the boundaries of the tongue, the combined radical neck dissection with resection of the mandible and tongue is a satisfactory procedure.

Prognosis

The prognosis is dependent directly on the involvement of cervical nodes The five-year end results are approximately three times better in the patient who never has demonstrable cervical metastases than in the patient with positive adenopathy

DIFFERENTIAL DIAGNOSIS

Because carcinoma of the tongue extends so rapidly, no persistent lesion should be treated without benefit of microscopic examination In order to furnish the pathologist with an adequate clinical description of the lesion, a differential diagnosis on macroscopic grounds must be attempted



FIG 7 41—Localized, advanced leukoplakia surrounded by abnormal atrophic mucous membrane Typical precancerous changes were demonstrated microscopically

Precancerous Lesions

Leukoplakia The single most important precursor of lingual carcinoma is leukoplakia The normal papillary anatomy of the dorsum of the tongue precludes identification, either clinically or microscopically, of leukodema, which is often an early stage of this lesion Although infrequently seen, the earliest recognizable form is a hyperkeratosis covering the most superficial portion of the papillae Only rarely is leukodema seen on the smooth mucosa of the sides, and then only when associated with a generalized extension over most of the other oral surfaces

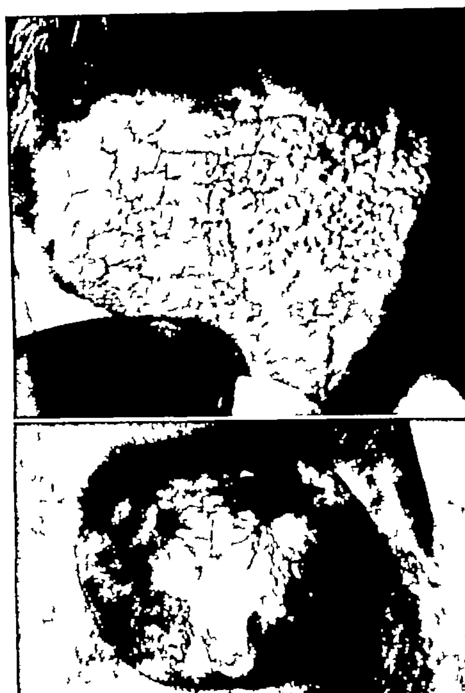


FIG 7 42 (*Upper*)—Advanced leukoplakia covering the dorsum with a fenestrated pattern. The thickness of the lesion caused a limited mobility

FIG 7 43 (*Lower*)—Advanced leukoplakia and mucosal atrophy associated with luetic glossitis. The mucosal changes with inflammation are characteristic of the disease

FIG 7 44 (*Upper*)—Advanced leukoplakia with inflammation complicating a lesion of glossitis rhombica mediana

FIG 7 45 (*Lower*)—A small area of advanced leukoplakia with minute area of carcinomatous change in the lower portion



Fig 7 46 (*Upper*)—Superficial carcinoma developing on abnormal mucous membrane with atrophic and leukoplakic changes.

Fig. 7 47 (*Lower*)—Completely altered mucous membrane showing early carcinoma, chronic ulcer leukoplakia, and atrophy

Leukoplakia is seen with considerable frequency on all aspects of the mobile portion of the tongue It does not appear posterior to the circumvallate papillae or in the pharynx When it appears on the dorsum, a plaque varying from a filmy thickness to as much as 5 mm is observed The normal papillae are always absent in these areas Fissures or punctate desquamations within such zones of keratosis are the most accurate guides for selection of biopsy sites Induration or fixation in tissue beneath these plaques indicates cancerous change and requires immediate microscopic evaluation

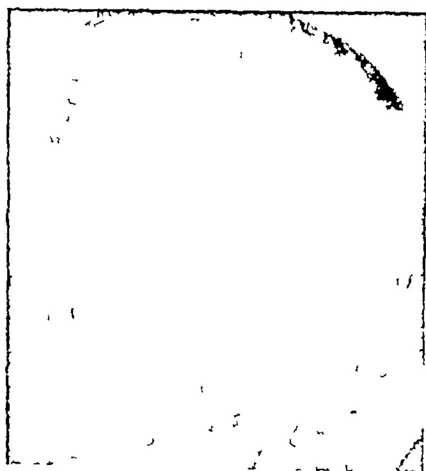


FIG 7 48—Lichen planus with the characteristic areas of hyperkeratosis and inflammation

When leukoplakia is observed on the sides or ventral surfaces, it is seldom sufficiently thick to mask completely the underlying rubor of the mucosa without also evidencing fissuring, ulceration, and/or deep inflammatory reaction This type of lingual leukoplakia may arise from any, or a combination, of the general etiologic factors discussed in Chapter 3 However, mechanical trauma of dental origin occurs especially on the sides, thermal and chemical trauma from tobacco use occurs on the anterior third of the dorsum, and the use of snuff and chewing tobacco is most frequently associated with the ventral sites

Leukoplakia with a Luetic Background The dorsal surface is most often involved in such cases Heavy plaques are present in several separate areas The intervening mucosa frequently lacks papillae and has in some areas thin, filmy keratotic surfaces, similar to that observed in leukodema, while in other areas the leukoplakia is thicker Separating these zones, fine linear markings suggesting both more dense keratinization and scar formation are observed These zones and markings will occasionally extend to the sides of the tongue but more often are confined to the dorsum of the anterior two-thirds of the mobile portion The heaviest plaques are most often found at the points of dental trauma, i e , the sides of the tip

Altered Mucosa Overlying the Cicatrix from Severe Single Chemical or Thermal Burns A mucosa of this type must be considered as precancerous Such sites must be especially protected from mechanical injury from teeth or appliances to prevent cancerous transformation

Abnormal Mucous Membranes In most patients with oral cancer abnormal mucous membranes are observed A varying combination of contrasting extremes is present (1) from a generalized pallor to a diffuse

erythema (2) from a lack of normal keratinization to a leukoplakic thickening and (3) from an atrophy of the filiform papillae to a hyper trophy of the fungiform papillae on the dorsum of the tongue Similarly we recognize abnormal altered mucosa and consistently observe com binations of the following microscopic changes (1) atrophy (2) hyper keratinization, (3) marked epithelial hyperplasia, (4) frequent dyskera tosis, (5) carcinoma in situ (6) diminution or absence of minor salivary glands, (7) abnormal round-cell infiltration (8) fibrosis of the sub-mucosa. From these observations we may conclude that carcinoma rarely



FIG. 7 49—Chronic inflammatory ulcer following injury with leukoplakic for mation around the border

if ever arises on normal mucous membrane and that precancerous pathology must include additional abnormal states of the epithelium

Leukoplakia as a precancerous condition is well established while mucosal atrophy is becoming recognized as a common companion of carcinoma of the oral surfaces The appearance of the mucous mem branes associated with cancer of the tongue is described as smooth or thin, with a diminution or absence of the filiform papillae The irritative mucosal atrophy may be evident on any or all surfaces, and it frequently gives the tongue a bald shining smoothness Additionally in the presence of gross oral sepsis the irritation and erythematous changes are usually marked.

Inflammatory Lesions

These lesions may arise on the basis of mechanical, thermal, and chem ical factors or from local and systemic diseases.

Chronic Ulcers Infection is always present in chronic ulcers. Clinically they cannot be accurately diagnosed. Tuberculous and traumatic lesions may be moderately firm but are not fixed to the underlying structures

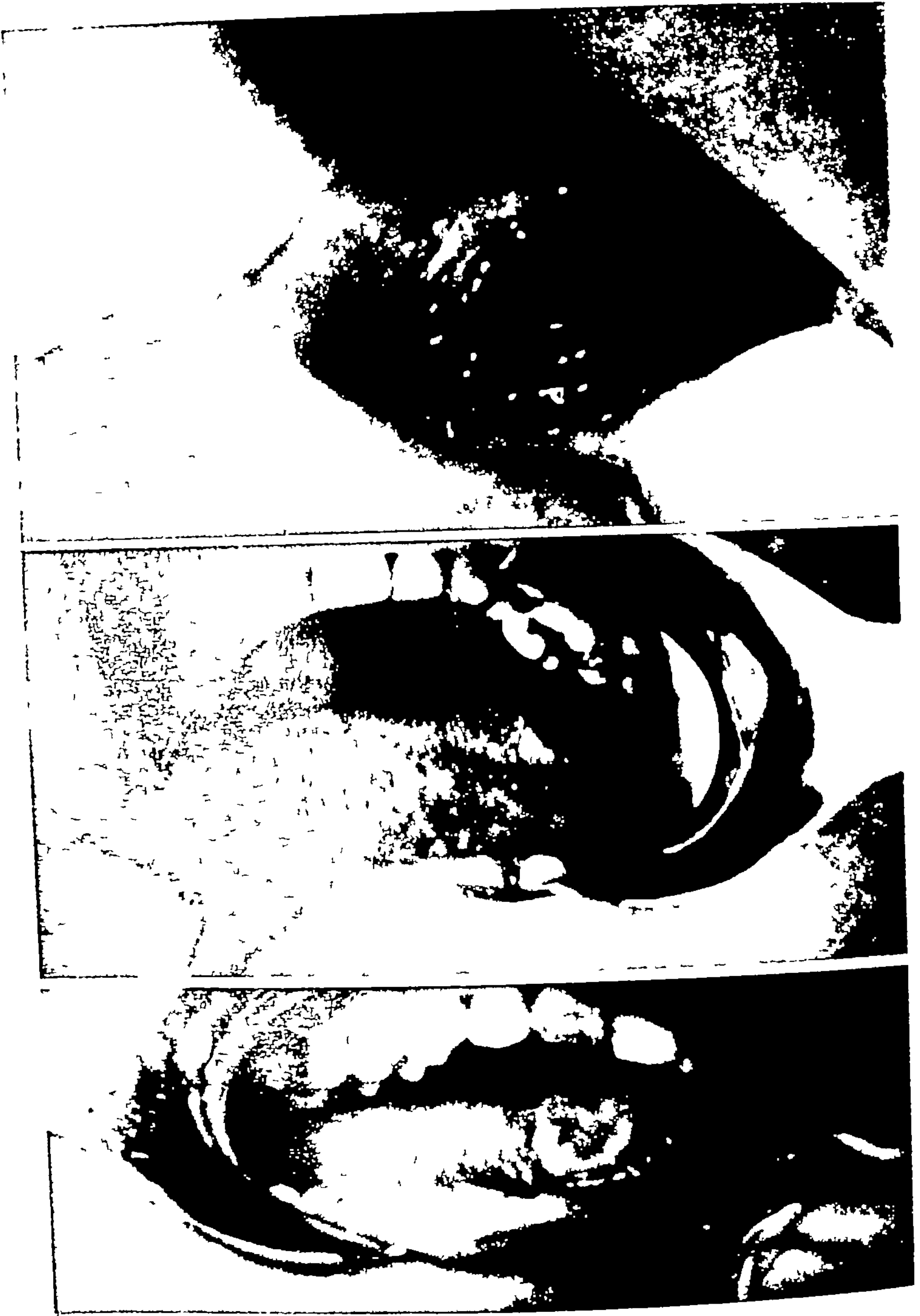


FIG 7 50 (*Upper*)—Chronic nonspecific ulcer

FIG 7 51 (*Center*)—Chronic nonspecific inflammation of the lingual tonsillar area frequently mistaken for carcinoma

FIG 7 52 (*Lower*)—Chronic nonspecific granulomatous ulcer

The chancre of primary syphilis has a rolled edge somewhat more firm and moderately fixed to adjacent tissues but lacks the classic induration of a cancerous lesion of comparable size Moderate pain and tenderness may accompany a traumatic lesion, while it may be absent in tuberculosis and syphilis. Varying degrees of adenopathy may accompany any of these lesions Signs and symptoms are of no value in ruling out carcinoma. Adequate biopsy will confirm a presumptive diagnosis in the

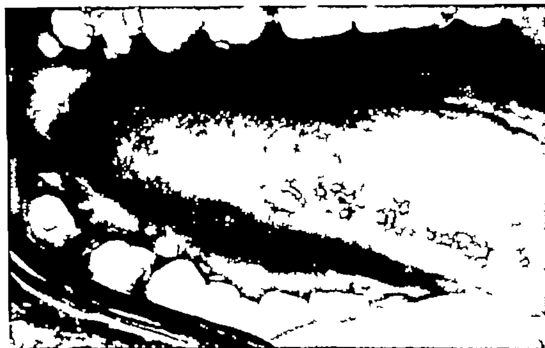


FIG 7 53—Mucosal wart.

majority of cases and will identify cancer if it is present. Dark field serologic, and bacteriologic studies may be done concurrently with biopsy but they do not precede or preclude this definitive step

Acute Ulcers Those most often seen on the tongue are of viral origin (canker sores) They are flat and surrounded, as a rule by a narrow zone of intense erythema. This margin is not thick, although thickness and increased firmness may be found in older lesions beneath the ulceration itself The history of slight awareness of pain prior to the visual discovery and the acute burning pain of the fully developed lesion are further aids in diagnosis Soothing medicaments should be applied locally Chronically recurrent canker sores are difficult to manage (see Chap 9)

Glossitis Rhombica Mediana This inflammatory lesion of the tongue appears just anterior to the V formed by the vallate papillae It is characterized by the presence in the midline of a nonulcerated mass or plaque which may extend forward 1 0 to 3.0 cm but is sharply de

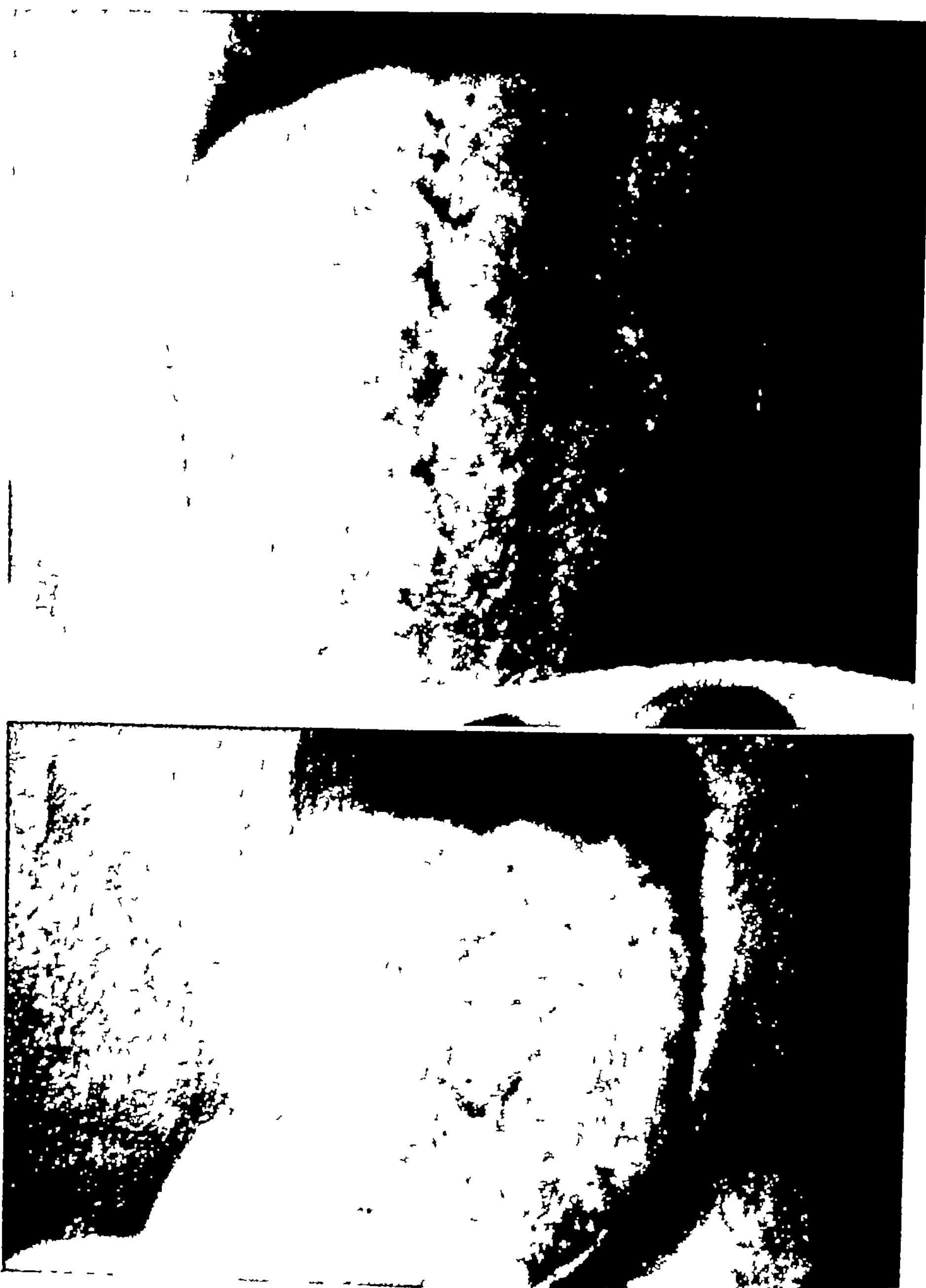


FIG 7 54 (*Upper*)—Small superficial eroded lesion of tuberculosis
FIG 7 55 (*Lower*)—Advanced nonulcerated tuberculous lesion



FIG 7 56—Raised granulomatous lesion with the beefy vascular and characteristic appearance of a gumma tertiary syphilitic lesion.

FIG 7 57—Nonspecific abscess.

marcated posteriorly by the sulcus terminalis. The lesion may be elevated, smooth, nodular, fissured, or slightly indurated. The color is usually pink, in contrast to the darker red of the normal surface of the tongue. Clinically, these lesions do not change in size On microscopic examination they are sharply demarcated and confined to the mucosa and submucosa The mucosa is hypertrophied, with hyperkeratosis and papillary

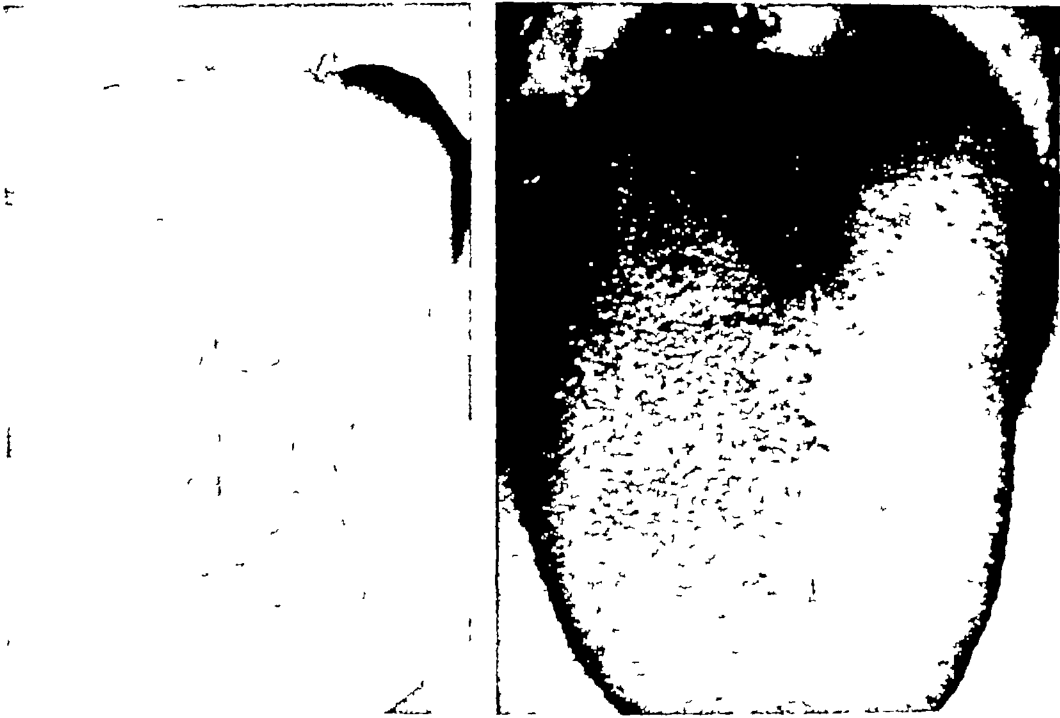


FIG 7 58 (*Left*)—Smooth plaquelike lesion anterior to the circumvallate papillae Glossitis rhombica mediana

FIG 7 59 (*Right*)—Irregular inflammatory lesion with a dark-red color and with loss of tongue markings Glossitis rhombica mediana.

bodies prominent In the submucosa are many lymphocytes and generous numbers of plasma cells The lymphocytes tend to form aggregates which hug the elongated epithelial downgrowths There is an associated increase in the number of capillaries and lymphatics and a variable amount of fibrosis The pathogenesis is not understood Although pain and tenderness are usually absent, superimposed fungus and other infections may cause symptoms

Geographic Tongue A fairly common inflammatory affection, geographic tongue may or may not be associated with symptoms The exact etiology of this condition is not known, but a relationship to dietary and digestive function and to bacterial floral variations within the gastrointestinal tract is suggested Typically, these lesions appear in one or more areas on the dorsum of the tongue as small irregularly ringed white



Fig 7 60—Lesion of glossitis rhombica mediana of long standing with a smooth mucosa and a firm rubbery consistency



Fig 7 61—Geographic tongue with a large area of atrophic mucosa and a characteristic superimposed lesion with pink center and white peripheral margin.

markings These are rows of filiform papillae, two or three in depth, usually with a prominent white coating The area enclosed by this geographic ring is as a rule, devoid of filiform papillae Occasionally a few fungiform papillae remain, leaving a bald erythematous area. The rings



FIG 7 62 (*Upper*)—Fissured tongue with mucosal atrophy on the sides
FIG. 7 63 (*Lower*)—True squamous-cell papilloma

usually gradually increase in size, spreading over the dorsum of the tongue to coalesce with one another to form irregular, maplike patterns

Sixty per cent of patients with this affection will complain intermittently of soreness and rawness of the tongue, confined to the denuded and inflamed portions Thirty per cent (not all falling within the 60 per cent group) will, in addition, complain of varying sensations of generalized burning of the tongue, not specifically related to the areas of geographic components Over 25 per cent of geographic tongues are



FIG 7 64 (*Upper*)—Pseudopapilloma as a result of injury from the irregular sharp broken cusps of the teeth.

FIG 7 65 (*Lower*)—Pseudopapilloma resulting from trauma from the absent first molar tooth.



FIG 7 66 (*Upper*)—Long-standing papilloma covered by a precancerous type of leukoplakia

FIG 7 67 (*Lower*)—Localized area of papillomatosis

associated with the fissured tongue in which the filiform papillae are of an abnormal anatomic pattern. The circumscribed areas within geographic markings on such tongues are likewise nearly bald



FIG 7 68 (*Upper*)—Fibroma.
FIG. 7 69 (*Lower*)—Neurofibroma.

These lesions respond in part to various forms of treatment mild oxygen releasing drugs fungicides intensive vitamin and/or high protein diet therapy

Benign Tumors

The benign tumors considered here do not have a higher expectancy of cancerous change in lingual sites than in any other part of the body However any tumor that appears to be clinically benign may have been

cancer from the start, so that microscopic diagnosis in these locations is required

Papillomas Two varieties are recognized on the tongue

TRUE SQUAMOUS PAPILLOMA This type arises on a broad base, is covered by mucosa, which because of proliferation assumes a papillary form, and is well demarcated from the normal surrounding mucosa

PSEUDOPAPILLOMA The result of a repair process which takes place after mechanical injury, a pseudopapilloma is pedunculated, because of

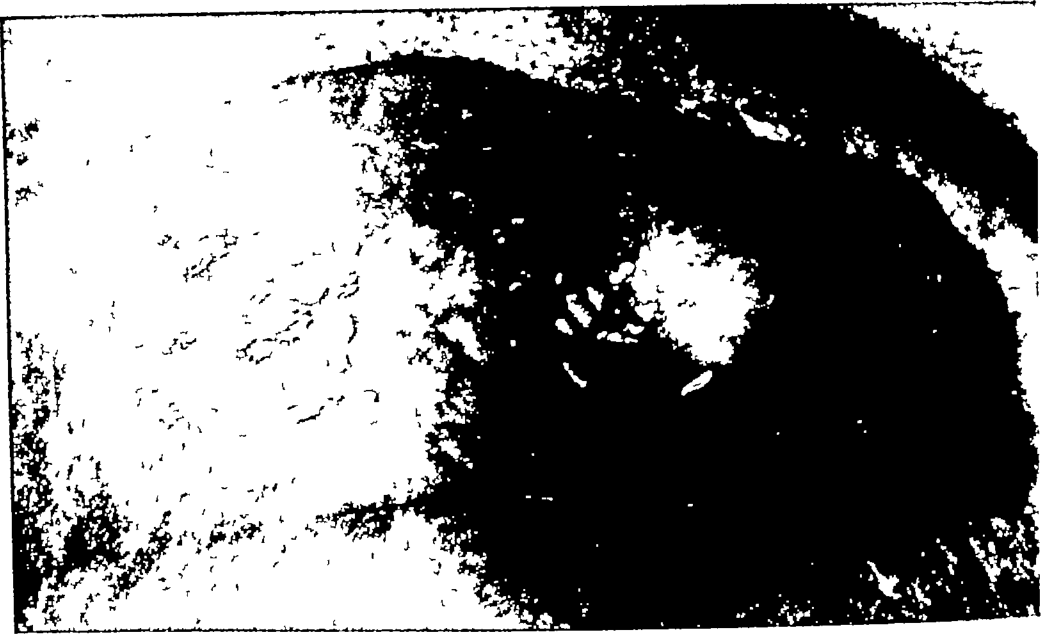


FIG 7 70—Benign granular-cell myoblastoma

the proliferation of the fibrous tissue, and is covered by smooth oral epithelium The fissured, or scrotal, type of tongue has a special capacity for this abnormal repair process following trauma, and three or four such proliferations from 1 to 5 mm in size are not infrequently seen on tongues of this type

TRUE FIBROMAS On the tongue, true fibromas are relatively rare They occur most frequently on the dorsal surface and are usually gray or grayish white but occasionally blend with the color of the mucosa They grow slowly and are lobulated Texture and consistency depend on the collagen content Histologically, the tumor is made up of fibroblasts which are usually larger and more numerous than in normal connective tissue Fibromas are treated by excisional biopsy for diagnosis and cure

TUMORS ARISING FROM LINGUAL MUSCLE (STRIATED) For many years such tumors have been recognized The benign granular-cell myoblastoma is among the debatable tumors Some contend that it arises from the neurilemma cells of the nerve sheaths, while others believe that it arises

from myoblasts The cells are large and polyhedral in shape with a relatively small nucleus and a large amount of granular pink staining cytoplasm. They do not become large and, when located beneath the



FIG 7 71 (*Upper*)—Cavernous hemangioma.
FIG 7 72 (*Lower*)—Multiple cavernous hemangiomas.

mucosa, are often associated with a pseudoepitheliomatous hyperplasia of the latter This may be so marked as to be mistaken microscopically for carcinoma. Excision for biopsy and cure is usually sufficient treatment.

Hemangiomas Some hemangiomas may be observed at birth, others may appear during infancy and childhood While there are numerous clinical and pathologic subdivisions of hemangiomas (when the body as a whole is considered) a more restricted classification may be adopted

FIG. 7-73. Interstitial hemangioma involving half the tongue

FIG. 7-74—Capillary hemangioma.

for those occurring in the tongue and oral cavity Hemangiomas which follow trauma are histologically indistinguishable from those of apparent spontaneous origin Not infrequently hemorrhage is a serious complication and may be caused by trauma biopsy or ulceration. Malignant transformation is exceedingly rare in intraoral locations For our purpose hemangiomas may be divided into cavernous capillary and mixed.

CAVERNOUS VARIETY A hemangioma of this type is soft, compressible, and dark in appearance. Pulsation is not usual The lesion may be localized to any portion of the tongue or may be diffuse, giving rise to macroglossia. The large dilated spaces are prone to spontaneous thrombosis and calcification which may produce hard nodules within the tumor Large vascular spaces lined with mature endothelium are present and separated by a thin connective-tissue septa Some however have a smooth muscle component with associated fatty tissue and dilated lymphatics These are of venous origin. Early they are superficial but with growth the muscle becomes involved resulting in atrophy and fibrosis Thrombosis with organization and phlebolith formation is common

CAPILLARY TYPE. Hemangiomas of this type may be due to a superficial ectasia of the capillaries (port wine stain) and have a flat, non elevated surface or more active blood vessel proliferation may produce a spongy nodular growth. This lesion varies in color from pink to bright red and blanches on pressure In the more active type there is an excessive amount of endothelial proliferation scattered as solid masses among the sprouting capillaries, and sudden periods of growth are not unusual. Extension into adjacent oral surfaces is common and may be complicated by ulceration, hemorrhage and infection

MIXED CAVERNOUS AND CAPILLARY HEMANGIOMAS. This type is common If histologic preparations are made the majority of such hemangiomas will display components of each type The epithelium overlying any hemangioma may be thickened and roughened or it may be thin and atrophic because of tumor tension Tumors located on the sides of the tongue and in other areas subject to trauma are more prone to early ulceration and infection

Lymphangioma This type of tumor is similar to the hemangioma in background and behavior the difference being that lymphangiomas arise in lymphatic rather than in blood vascular tissue Such a tumor usually occurs during infancy and childhood and appears as an irregular soft, nodular lesion usually on the dorsum of the tongue At first the lesions are located superficially and the surface vessels vary in color from opaque white to blood red. The latter coloration is due to the fact that many of the dilated spaces contain extravasated blood instead of lymph. Where a large admixture of blood is present, the term *hemolymphangioma* applies. Episodes of growth may ultimately cause macroglossia. Occa

sionally these tumors are associated with congenital cystic hygroma of the neck (multicystic lymphangioma)

Microscopic differentiation between lymphangioma and hemangioma may be difficult because the vascular structures are identical and the clear lymph fluid may contain blood elements

Hemangiopericytoma This is a vascular tumor differing from the angiosarcoma and hemangioma in that the cell of origin is the pericyte of Zimmermann This is an adventitial cell of capillaries which may pro-



FIG 7 75—Mixed cavernous and capillary hemangioma.

liferate and simulate a smooth-muscle cell, mimic epithelium (epithelioid), or produce collagen and look like a fibroblast From the microscopic pattern it is not always possible to tell the benign from the malignant growth These tumors, characteristically, have innumerable capillaries which are not always apparent with the routine tissue stains but are quite apparent when Laidlaw's silver reticulin-impregnation method is used Proliferating around the capillaries and filling the spaces between are the characteristic round to spindle-shaped cells The capillaries are only potential spaces The tumors, grossly circumscribed but not encapsulated, are firm On sectioning, the surfaces are usually not hemorrhagic but gray-white

Thyroglossal Cysts, Fistula, and Lingual Thyroid Tissue These conditions are better understood if the development of the thyroid, as well as the defects which may occur, are described

EMBRYOLOGIC DEVELOPMENT The thyroid gland develops from the ventral wall of the pharynx between the capula and the tuberculum impar of His From this region the thyroglossal duct grows ventrally

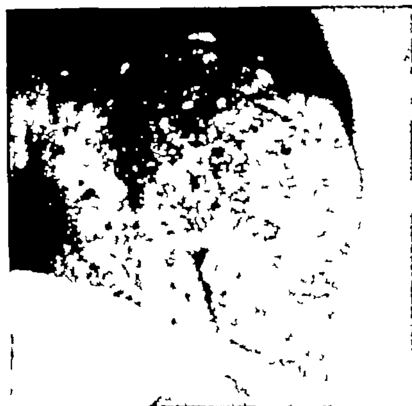


FIG 7 76—Lymphangioma. The dark nodules are the blood vessel structures the white are the lymphoid tissue



FIG 7 77—Lymphangioma with predominantly lymphoid tissue.

the regional nodes may be expected. The lesion is often quite responsive to radiation but is not controlled for long periods of time because of its tendency to disseminate widely and early.

Adenocarcinoma As a primary lesion of the tongue, this tumor is very rare When it appears, it is associated with the seromucinous salivary glands This tumor is fully discussed in Chapter 11 Treatment of this disease in the tongue, however, is similar to that of other carcinomas in this site



FIG 7 79—Focus of chronic myelogenous leukemia with an irregular leukoplakic peripheral margin

READING REFERENCES

ACKERMAN, L V, and R JOHNSON "Present-day concepts of intraoral histopathology," *Proc Second National Cancer Conference* 1.403–414 (1952)

BYARS, L T, and R ANDERSON "Multiple cancers of the oral cavity," *Am Surgeon* 18 386–391 (1952)

CADE, S *Malignant Disease and Its Treatment by Radium*, 2d ed The Williams & Wilkins Company, Baltimore, 1949

GIBBEL, M I, J H GROSS, and I M ARIEL "Cancer of the tongue review of 330 cases," *Cancer* 2 411–423 (1949)

JACOBSSON, F "Carcinoma of the tongue a clinical study of 277 cases treated at Radiumhemmet 1931–1942," *Acta Radiol Suppl* 68.1–184 (1948)

MARSHALL, S F, and W F BECKER "Thyroglossal cysts and sinuses," *Ann Surg* 129 642–651 (1949)

MARTIN, H E B DEL VALLE, H EHRLICH, and W G CAHAN "Neck dissection," *Cancer* 4 441–499 (1951).

MURRAY, M R "Cultural characteristics of three glandular-cell myoblastomas," *Cancer* 4 857–865 (1951)

SHARP G S., E. W DEMAREE, and R E PUGH, JR "Radiation vs. surgery for cancer of the tongue" *Western J Surg Obstet Gynecol* 58:257–270 (1950)

STOBBE, D G and H W DARGEON "Embryonal rhabdomyosarcoma of the head and neck in children and adolescents," *Cancer* 3:826–836 (1950)

STOUT A P "Hemangiopericytoma a study of twenty five cases," *Cancer* 2:1027–1035 (1949)

TAYLOR, G W., and I T NATHANSON *Lymph Node Metastases Incidence and Surgical Treatment in Neoplastic Disease* Oxford University Press, New York, 1942

ULIN A W W C SHOEMAKER, and G F FROIO "Rhabdomyosarcoma of the tongue," *New Engl J Med* 250:98–104 (1954)

CHAPTER 8

Lesions of the Floor of the Mouth

Without thorough examination small lesions occurring in the floor of the mouth are frequently overlooked and may go unnoticed until they either reach considerable size or become painful to the patient

APPLIED ANATOMY

The floor of the mouth, or sublingual region, is semilunar in shape and extends from the symphysis laterally on both sides to the junction of the base of the tongue and anterior tonsillar pillar It is supported anteriorly by the mylohyoid muscles which separate the tissues in the floor of the oral cavity from the neck The mylohyoid muscle finds its origin in the midline close to the lower border of the mandible, and extends posteriorly and diagonally across the inner surface of the mandible, inserting in the mylohyoid ridge opposite the second molar tooth It serves as a definite barrier between the mouth and the neck In the areas opposite and posterior to the third molar tooth, there is direct continuity between the tissues of the two areas As compared with carcinoma of the posterior zone where direct extension to the neck is uninterrupted carcinoma of the anterior two-thirds of the floor of the mouth is less likely to infiltrate the tissues of the neck until later in the disease

The floor of the mouth is covered by squamous epithelium similar to that which lines the rest of the oral cavity The frenum divides the floor at the midline Wharton's duct opens in the center of a small nodule on either side Lateral to each nodule is another smaller opening the orifice of the sublingual glands The lymphatics of this region are continuous with those of the tongue and empty into the submental, submaxillary, and the deep jugular chain of nodes

CARCINOMA OF THE FLOOR OF THE MOUTH

Clinically, carcinomas of the floor of the mouth simulate those in the base of the tongue more closely than those of other oral surfaces Local

growth is rapid, and metastases frequently occur early For these rea sons a thorough inspection and palpation are essential to recognition of these growths in the most treatable stage

Incidence

The floor of the mouth is affected by squamous carcinoma in approxi mately 13 per cent of all such tumors in the oral cavity The occurrence is more frequent in males (3.5 1) and the average age at detection is



FIG 8 1—Minute carcinoma arising on the lingual frenum In the absence of dental appliances, poor oral hygiene and constant pipe smoking are assumed to be inciting factors.

fifty six years The majority of the growths develop on or to one side of the frenum Tumors in this region are more frequently a crucial problem than the number of primary growths would indicate because approximately 30 per cent of the carcinomas of the tongue and gingiva invade the floor of the mouth directly

Etiology

Carcinoma of the floor of the mouth is rarely seen without leukoplakia or other precancerous lesions

1 *Trauma from dentures is a common inciting factor for carcinoma of* the frenum the majority of patients with this lesion are edentulous Along the lateral border of the floor of the mouth chronic inflammation may be produced by a maladapted lingual flange. Careful attention should be given to all inflammatory areas related to dental appliances
2. Hygiene in these patients is uniformly bad



FIG 8 2 (*Upper*)—Small carcinomatous ulcer invading the left sublingual gland

FIG 8 3 (*Lower*)—Carcinomatous ulcer involving the lingual frenum and sub lingual gland

3. Leukoplakia in this area of the oral cavity is less common than elsewhere Its presence especially in this location is regarded as a danger signal.
4. Gastrointestinal disturbances associated with recurrent canker sores avitaminosis B smoking use of chewing tobacco and snuff are frequently noted.

Histopathology

1. Lesions in the floor of the mouth are most often squamous-cell carcinomas usually of a Grade II or III
2. Lesions of the anterior two-thirds of the floor of the mouth are frequently of a lower grade are usually associated with leukoplakia, and are less aggressive than lesions in the posterior region where invasion and early metastases are the rule.

Clinical Characteristics

Not only is the floor of the mouth a relatively hidden area but also the mucous membrane is well separated from fascia and muscle by a loose connective tissue and salivary glands. These anatomic structures may allow growths to develop to a considerable size without giving rise to symptoms. When the frenum muscles or mandible become involved, symptoms appear

1. An abnormal thickening, sore, or nodule is the initial sign described by the patient Less commonly such growths are discovered during an examination visually or by palpation
2. Invasion by the primary growth is relatively rapid, and early extension beyond these regional boundaries is common Signs and symptoms associated with progression of disease are local soreness pain, ulceration and excessive salivation Later deviation of the tongue on protrusion, speech difficulties and painful deglutition become apparent.
3. A lump in the neck may be a metastasis from a relatively insignificant looking primary lesion in the floor of the mouth.
4. Clinical types most frequently recognized are exophytic (papillomatous) and endophytic (ulcerous) They may appear with or without leukoplakia. Each type has a characteristic aggressive behavior which is further modified by anatomical position

   a. The exophytic type arises as a papillary lesion Compared with the endophytic type growth is slower and the occurrence of metastases is somewhat later
   b. The endophytic, or ulcerous, growths are more aggressive, with muscle invasion occurring relatively early The margins of the





FIG. 8 4 (*Upper*)—Nodular carcinomatous lesion in the right anterior floor of the mouth with fixation to the periosteum of the mandible

FIG. 8 5 (*Lower*)—Classical crateriform carcinomatous ulcer in the midportion of the right floor of the mouth



FIG. 8 6 (*Upper*)—Exophytic or evertive form of carcinoma with superficial ulceration.

FIG 8 7 (*Center*)—Evertive carcinoma invading the lingual frenum and periosteum of the mandible

FIG. 8 8 (*Lower*)—Exophytic carcinoma with roentgenographic evidence of invasion of the mandible.



FIG. 8-9 (*Upper*)—Infiltrative carcinoma with invasion of the tongue and mandible.

FIG. 8-10 (*Lower*)—Infiltrative carcinoma complicated by inflammation in the tumor area.



FIG. 8 11—Carcinoma with extensive infiltration and inflammation.



FIG. 8 12—Ulcerous and infiltrative carcinoma with invasion of the tongue and mandible.

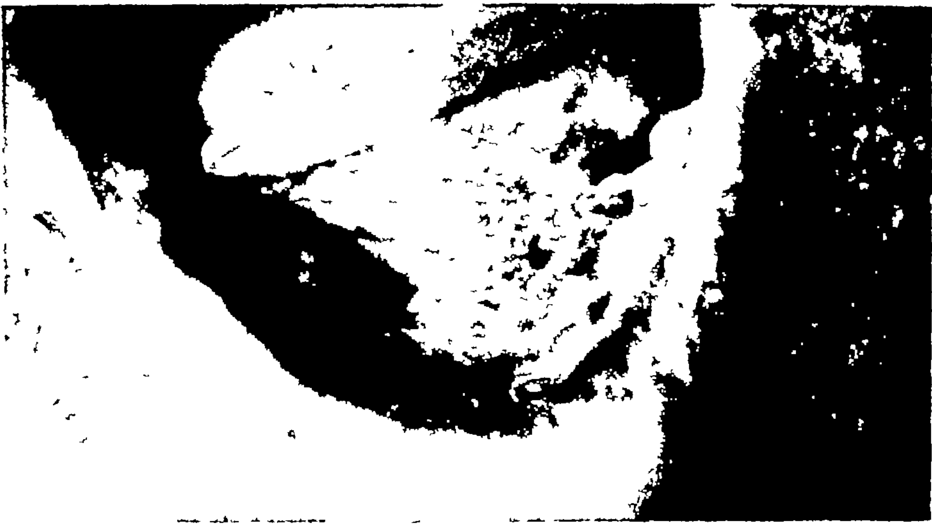






FIG. 8-13 (*Upper*) Carcinoma covering the anterior half of the floor of the mouth and undersurface of the tongue

FIG. 8-14 (*Center*) Ulcerous carcinoma invading the anterior floor of the mouth and sublingual tissues

FIG. 8-15 (*Lower*) Bulky ulcerous carcinoma, with extensive invasion of the floor of the mouth and sublingual tissues





FIG 8 16 (*Upper*)—Extensive carcinoma with secondary invasion of mandible and sublingual tissues

FIG. 8 17 (*Lower*)—Tumor tissue being obtained with biopsy forceps from an ulcerous carcinoma.

ulcers are indurated, and metastases to cervical lymph nodes occur rapidly

c A nonulcerated painful nodule or thickening is observed infrequently in front of the anterior tonsillar pillar The behavior is that of an invasive carcinoma with direct extension into the tissues in the neck and concomitant cervical metastases

Diagnosis

1 All lesions in the floor of the mouth should be considered cancer until the biopsy proves otherwise
2 A biopsy is a relatively simple procedure and does not involve risk of disseminating the disease The technique followed is the same as that described for carcinoma of the tongue Antiseptic precautions are necessary and, whenever possible, the incision for the biopsy should not be carried through the base of the lesion Care in this last particular reduces the possibility of an unnecessary complication by introducing infection

Treatment

The type of treatment varies primarily according to the accessibility of the growth the size of the primary lesion, and whether or not it has invaded bone or extended beyond the other boundaries of the floor of the mouth Early detection is increasing the number of patients with primary growths of 1 5 to 2 0 cm in diameter Such growths are ideally treated by surgery or irradiation with excellent functional results.

Prophylactic Oral Hygiene This treatment is instituted at the time of biopsy and as nearly as possible is completed without delaying treatment of the primary lesion All oral inflammation must be controlled, and in certain instances where peroral roentgen therapy is required, any necessary extractions of teeth which would prevent the application of a cone must be done prior to the radiation treatments Antibiotic therapy is a tremendous adjunct to this hygiene plan

Treatment of the Primary Growth This may be successfully accomplished by either surgery or irradiation

SURGERY The treatment of choice in most of the small lesions and in all the more advanced primary growths is surgery Wide local excision is ideally suited for lesions with a diameter of 1 0 to 2 0 cm which are centrally located and not adherent to the periosteum of the mandible To ensure a complete removal of the tumor, at least a 1 5-cm margin of normal tissue should be removed on all sides as well as from the base For growths occurring anteriorly, this is an ideal procedure and the cut edge on the undersurface of the tongue is approximated to the

mobilized gingival mucosa The tongue usually regains its mobility and function.

More advanced primary growths which are either small with demonstrable cervical node metastases or have extended beyond the boundaries of the sublingual area with or without cervical nodes, require radical surgery The basic surgical principle is to remove the primary lesion and the contents of the neck on the affected side in continuity



FIG. 8 18—Gross surgical specimen of a carcinoma of the floor of the mouth which had secondarily invaded the tongue and gingiva Block removal of half the tongue floor of the mouth, the body of the mandible and contents of the side of the neck was performed.

1. The small primary lesion may be widely incised and a so-called pull through accomplished from below after the radical neck dissection. Other lesions are more adequately exposed by dividing the lip and mandible in the midline The reuniting of the mandible and plastic repair of the lip ordinarily result in excellent function
2. Primary growths that have invaded the tongue or mandible invariably require a block removal of a portion of the tongue the floor of the mouth, the mandible and the contents of the neck on the affected side. Primary lesions with this extent of invasion have a high incidence

of cervical node metastases For these cases a wide excision of the primary growth should always be combined with a radical neck dissection

RADIATION PROCEDURES Such methods are ideally adaptable to small primary lesions which are readily accessible and have less than 1 0-cm depth of invasion Entirely superficial lesions may be treated with surface radium therapy by means of a dental mold, or, if readily accessible, may be eradicated by roentgen therapy through a peroral cone

Whatever method of irradiation is used, the total amount of tissue roentgens to be administered must be carefully calculated in accordance with the size and depth of the growth By either procedure, it is advisable to deliver at least 6000 tissue roentgens

Treatment of Cervical Metastases This is equally as important as the consideration of the primary lesion, since the incidence of occurrence is similar to that of carcinoma of the tongue Approximately 30 to 35 per cent of patients with carcinoma of the floor of the mouth demonstrate metastases on admission while 20 to 25 per cent develop metastases subsequently i e , a total of 50 to 60 per cent, as compared with 60 to 65 per cent for carcinoma of the tongue

The treatment is invariably a surgical procedure for all operable ipsilateral or contralateral disease A radical neck dissection is advised as a prophylactic procedure, even though nodes may not be clinically demonstrable

1 When the primary lesion has been treated by radiation, a radical neck dissection is accomplished two to three weeks after the active treatment
2 In all instances where the primary growth is excised, the radical neck dissection is performed at the same time, together with continuity of tissues between
3 The inoperable cervical disease may be controlled palliatively by external or interstitial radiation, alone or in combination

Prognosis

As in carcinoma originating in other areas of the oral cavity, the prognosis depends on the site and size of the lesion the grade, the extent of invasion into adjacent tissues and, last of all but probably most important the presence or subsequent appearance of metastatic disease in cervical nodes The five year survival rate varies from 17 to 45 per cent, with the majority of surgeons reporting the control of approximately 35 per cent of cases



FIG 8 19 (*Upper*)—Advanced leukoplakia with microscopic precancerous changes

FIG. 8 20 (*Lower*)—Superficial nodular carcinoma arising in an area of pre cancerous leukoplakia.

DIFFERENTIAL DIAGNOSIS

Precancerous Lesions

Altered or abnormal tissue states frequently are observed in the floor of the mouth Their inciting factor is trauma from dentures, and, conse-



FIG 8 21—Ulcerous and invasive carcinoma arising in precancerous leukoplakia.

quently, the most common area is on or near the frenum The site of greatest incidence for carcinoma of the floor of the mouth is also in this region, so that these two conditions have the same inciting factors, if not a more direct relationship

Leukoplakia This precancerous lesion is infrequently observed in the floor of the mouth and yet is associated more frequently with carcinoma here than on other oral surfaces The etiologic factors for leukoplakia are the same as for carcinoma of the floor of the mouth, i.e., trauma from dentures, smoking and dietary deficiencies Leukoedema, the frequent



FIG. 8 22—Minute ulcerous carcinoma arising in an abnormal atrophic mucous membrane of a patient with Plummer Vinson–syndrome

FIG 8 23—*Superficial ulcerous carcinoma arising on an abnormal atrophic and scarred mucous membrane.*

precursor to leukoplakia, presents a filmy whiteness covering the mucosa and is commonly observed in smokers' mouths. It is significant that this early form may disappear with discontinuance of the irritation. The precancerous type of leukoplakia is present in a localized and in a generalized form. The local disease is incited by direct trauma from dentures or by the habit of holding foreign bodies in the mouth (tacks, nails, hard candies, etc.). The generalized true leukoplakia is an opaque white, keratotic alteration of the mucous membrane, frequently with papil-



Fig. 8-21—Superficial sloughing ulceration of soft consistency. Secondary focus from active pulmonary tuberculosis.

lomatouslike growths on its surface. Such lesions are frequently observed covering the margin and epithelium around carcinomatous ulcerations. The treatment consists of improving the oral hygiene, prophylactic dental care, and correcting trauma and habits. Biopsy of any suspicious area is indicated, and excisional biopsy of the advanced localized plaques is often the treatment of choice.

Abnormal Atrophic Mucous Membranes. In nearly all patients with carcinoma of the floor of the mouth such membranes are observed. In denture cases, the condition of the mucous membrane is well demonstrated by its low tolerance to chronic trauma. In a certain number of cases, grossly irritated mucous membranes are manifested by the development of leukoplakia.

The formerly accepted etiologic factors do not adequately explain these abnormal states in the mucosa. The Plummer-Vinson syndrome is rarely responsible. An associated anemia, other than pernicious, is equally rare. The importance of vitamin deficiencies, with the exception of riboflavin deficiency, is overemphasized.

FIG 8 25—Pseudopapilloma of traumatic origin



FIG 8 26—Cavernous hemangioma involving the lingual frenum and floor of the mouth

In recent years a close relationship between atrophic oral mucosal changes and oral carcinoma has been demonstrated One can describe the oral cavity of the cancer patient as having a pale or slightly ery-

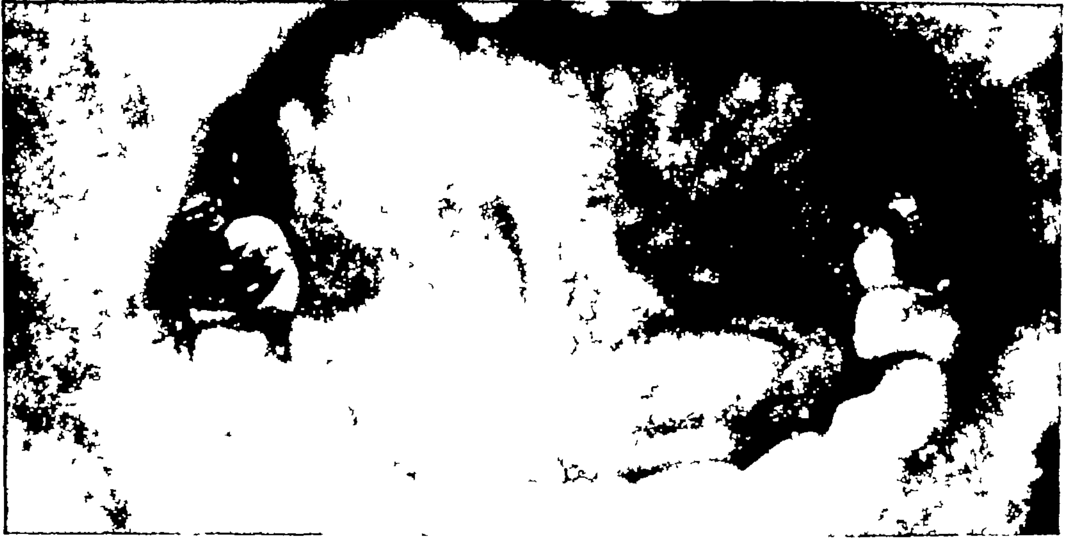




FIG 8 27 (*Upper*)—Bilateral ranula due to inflammatory obstruction of sublingual ducts

FIG 8 28 (*Lower*)—Ranula due to inflammatory obstruction of left sublingual and submaxillary ducts

thematous type of coloration with an apparent thinning of the mucosa. Symptomatically, patients complain of a dry, irritative, local or generalized soreness of the oral surfaces Microscopically, mucosal atrophy is

described as having a relatively lesser number of cell layers absence of papillae, and fibrosis of the submucosa and diminished or increased vascularity according to the coloration of the surface (see Chap 7)

Inflammatory Processes There is a close relationship between certain inflammatory processes and carcinoma of the floor of the mouth A more direct association is recognized in this area than on other oral surfaces



FIG 8 29—Simple retention cyst (ranula) of the right submaxillary gland which has distended the entire sublingual area, displacing the tongue upwards A calculus was demonstrated roentgenographically in the submaxillary duct.

Inflammatory Lesions

Simple Inflammatory Ulcers Such ulcers due to chronic inflammation, are often observed in the floor of the mouth. They may appear as herpetic lesions (canker sores) chronic superficial ulcers or fissures on the frenum or along the inner surface of the mandible. The lesions of herpes simplex are commonly associated with dysfunctions of the gastrointestinal tract, while other ulcers result from trauma of dentures and the habitual holding of foreign objects in the mouth. Carcinoma may develop on the margins of these traumatic ulcers

Tuberculous Ulcers This type of ulcer rarely seen in the floor of the mouth, is similar to the lesions of the tongue (see Chap 7)

Benign Tumors

Benign tumors are observed infrequently in the floor of the mouth The most common is the fibroepithelial papilloma, and it becomes sig-



FIG 8 30 (*Upper*)—Calculus in submaxillary duct prior to spontaneous extrusion

FIG 8 31 (*Lower*)—Lymphosarcomatous involvement of the tissues of the floor of the mouth

nificant only when irritation causes a leukoplakic response or when chronic inflammation develops An excisional biopsy is recommended Other benign tumors, such as hemangiomas, lipomas, hygromas and tumors of salivary glands are rarely observed

Other Malignant Tumors

Malignant tumors, other than squamous-cell carcinoma, are rare in the floor of the mouth When observed, they are found to be a focus of a generalized disease such as lymphosarcoma, Hodgkin s disease etc.

READING REFERENCES

BEISWANGER, R H and K W STENSTROM "Carcinoma of the cheek, alveolar processes, floor of the mouth, and palate" *Radiology* 44:213–224 (1945)

BEYER, T E and J R BLAIR "Sublingual rhabdomyoma" *Arch Otolaryngol* 47:678–680 (1948)

CARROLL, W W "Combined neck and jaw resection for intraoral carcinoma," *Surg Gynecol Obstet* 95:1–9 (1952)

HOWES W E and L BERNSTEIN "Oral carcinoma," *Radiology* 37:468–475 (1941)

IVY R. H., and L. CURTIS "Two cases of sublingual dermoid and case of protrusion of mandible," *Am J Orthodontics Oral Surg* (Oral Surgery Section) 31:666–675 (1945)

JOHNSTON W H "Cysts of the floor of the mouth," *Ann Otol Rhinol & Laryngol* 51:917–930 (1942)

KAPLAN I I "Cancer of the floor of the mouth," *J Am Dent Assoc* 30: 737–740 (1943)

LEDLIE, E M and M H HARMER "Cancer of the mouth a report of 800 cases," *Brit J Cancer* 4:6–19 (1950)

MARTIN H E., and E. D SUGARBAKER "Cancer of the floor of the mouth," *Surg Gynecol Obstet* 71:347–359 (1940)

MATTICK, W L. D J MEEHAN and J P HABERLIN "Squamous cell carcinoma of the floor of the mouth" *Surgery* 31:575–582 (1952)

SMITH, J B "Cancer of the floor of the mouth" *J Oral Surg* 6:106–115 (1948)

WARD G E and J O ROBBEN "A composite operation for radical neck dissection and removal of cancer of the mouth," *Cancer* 4:97–109 (1951)

WINDEMEYER, B W "Cancer of the floor of the mouth," *Brit J Surg* 41:231–237 (1953)

CHAPTER 9

Lesions of the Gingivae

The gingivae are vulnerable to a host of traumatic, inflammatory, and neoplastic diseases. Soreness, blood-streaked saliva, and ulceration—with or without dentures—may be the first signs and symptoms of carcinoma. The oral diagnostician, who is likely to be the first consulted, is therefore responsible for the early recognition of the lesion.

APPLIED ANATOMY

The mucosa covering the body of the mandible and the maxillae, as well as those of the gingivobuccal sulci, will be considered in this chapter. The gingivae proper, because of their anatomic relationship with the alveolar processes, are peculiarly susceptible to injury. The alveolar ridges are the most labile of supporting bony structures and may provide for a rapid extension of certain neoplasms, but their rich blood supply is part of an extremely potent defense mechanism against many infections. The point of attachment of the crevicular surface of the gingiva to the enamel or cementum of teeth is the weakest epithelial barrier in the body and is the only place where periosteum and epithelium join. The thickness and character of the epithelial portion of the mucosa vary widely. The crevicular surface facing the tooth and attaching to enamel or cementum is the thinnest and is nonkeratinized.

The character of the epithelial covering changes at the crest of the gingival ridge where the keratinization varies considerably in thickness, being heaviest on the upper anterior labial aspect covering the alveolar process and the lower buccal aspect of the posterior alveolar process. The thinnest keratinized layer is usually in the lower anterior area on the labial aspect. The mucosa overlying the body of the mandible is less keratinized and this transition continues into the reflecture forming the superior and inferior buccal sulci.

The lamina propria of the true gingiva is a dense, fibrous structure with a rich blood supply, elsewhere an additional loose submucosa is present. The regional lymphatic drainage has many intercommunications.

The mandibular areas in the anterior are drained directly into the submental and submaxillary nodes The anterior and posterior areas of the maxilla drain into the submaxillary nodes however both upper and lower posterior areas also have direct drainage into the superior deep cervical (jugular) group of nodes Medial to the cuspid teeth, contra lateral communication is frequent although contralateral metastasis is rare from carcinoma of the anterior maxilla and is not frequent from the mandibular region.

The anatomy of the underlying supporting bone of this region varies considerably in the several segments The labial and buccal plate of maxillary alveolar bone overlying the roots of the teeth is extremely thin, whereas the palatal alveolar bone is usually quite thick. In the mandibu lar area the alveolar bone on the lingual aspect of the teeth is thinner than on the buccal In general the blood supply of maxilloalveolar bone is richer than that of mandibuloalveolar bone, and the maxilloalveolar bone is less dense. The alveolar bone is less dense than the supporting medul lary bone of the body of either the mandible or the maxilla and the body bone of the mandible is more dense than that of the maxillary bone The invasion of neoplasms into the maxilla is frequently more rapid than in the mandible, for the following reasons (1) decreased density of bone (2) richer blood supply (3) the close proximity of the accessory nasal spaces the maxillary antra. In addition, there is frequently no bony barrier between the attachment of the upper posterior teeth in their alveolar sockets and the nasal spaces In the mandible the inferior mandibular canal provides an avenue for extension of the disease process but such extension tends to be slower

CARCINOMA OF THE GINGIVAE

Because of its easy visibility the gingiva lends itself admirably to examination and possible early detection of carcinoma. However clinical identification of carcinoma is not to be expected from a cursory glance Careful inspection, made with a high degree of suspicion, is requisite for competent diagnosis.

Incidence

Approximately 25 per cent of intraoral squamous carcinomas arise on the gingivae, and their occurrence is more frequent in males than in females 2 1. The average age at time of recognition is sixty years The lower alveolus is involved more frequently than the upper in a ratio of approximately 4 1 but this occurrence may be misleading since the maxilloalveolus is commonly invaded directly by carcinoma of the antrum and nasal cavity

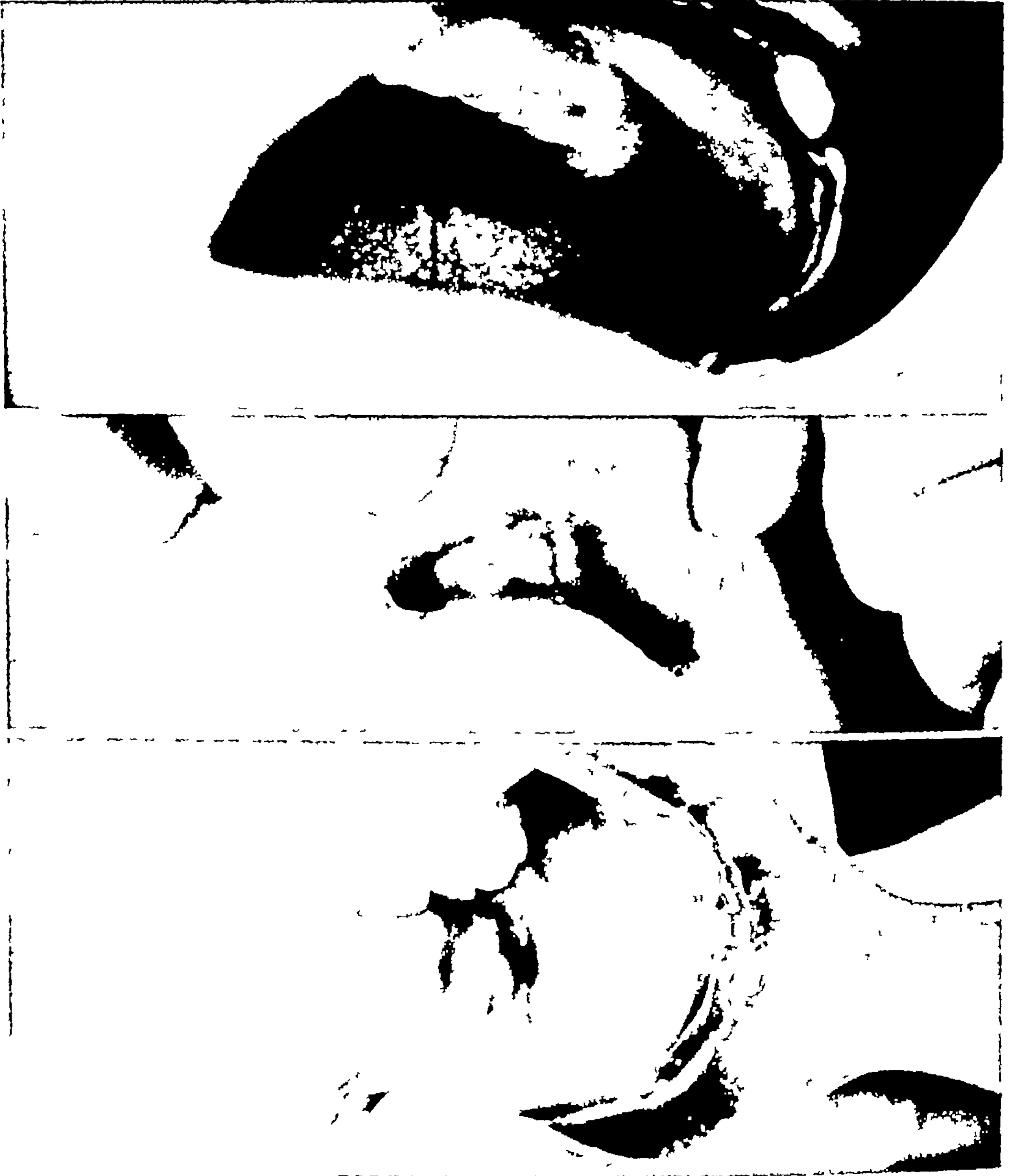


FIG 9 1 (*Upper*)—Crateriform carcinomatous ulcer
FIG 9 2 (*Center*)—Exophytic carcinoma arising on fibroepithelial hyperplasia
FIG 9 3 (*Lower*)—Superficial carcinoma on the gingival crest with a keratotic, irregular surface

Etiology

The etiology of carcinoma of the gingivae is similar to that of carcinoma arising on the tongue (Chap 7) In order of their importance as indicated by clinical observation these factors are (1) ill fitting or broken dental prosthetic replacements (2) oral sepsis with particular emphasis on chronic, long standing untreated pyorrhea alveolaris (3) leukoplakic and atrophic changes in abnormal mucous membranes (4) dietary insufficiencies induced by inability to absorb and utilize proteins as well as by inadequate intake of the B-complex vitamins (5) tobacco when used to excess (6) immoderate use of alcoholic beverages to the exclusion of a proper food intake (7) syphilis

Histopathology

The Majority of Carcinomas of the Gingivae These are characteristically identified microscopically by pearl formation and keratinization in Grades I and II The more rare Grade III epidermoid carcinoma has few if any pearl formations, an absence of keratinization, and a greater loss of polarity and more frequent mitoses

Leukoplakia A definite prognostic significance attaches to leukoplakia. Carcinomas associated with leukoplakia tend to spread in the early stages by infiltration of adjacent mucosa and lamina propria. Those unassociated with leukoplakia invade bone rapidly When the alveolus of a recent extraction site has been involved by a preexisting unrecognized carcinoma, the bone is invaded even more rapidly

Verrucous Carcinoma This is a rare and extremely deceptive type of lesion. The microscopic cellular morphology in many ways is that of a benign lesion although there is marked acanthosis deep papillary bodies, and the rete pegs seem to press their way into the underlying structures without violation of the basement membrane Evidence of bone destruction may be seen microscopically in those areas adjacent to the frontal attack of the enlarging rete pegs. There is an associated chronic inflammation in the vicinity of the proliferating epithelium.

Clinical Characteristics

Palpable thickenings granular erosions and advanced leukoplakic plaques are the earliest signs of gingival carcinoma and they are not always readily differentiated from periodontal disease (gingivitis)

Verrucous Carcinoma The least aggressive form of carcinoma arising on the gingiva, which is its most usual location, verrucous carcinoma arises also in the cheek, the lip and the tongue The growth is slow and results in a soft, bulky cauliflowerlike tumor It is most frequently seen in the mouths of those who chew tobacco or use snuff and is almost



FIG 9 4 (*Upper*)—Carcinoma arising in the fissure of fibroepithelial hyperplasia

FIG 9 5 (*Lower*)—Exophytic carcinoma projecting as an ulcerated spherical mass, simulating a benign lesion



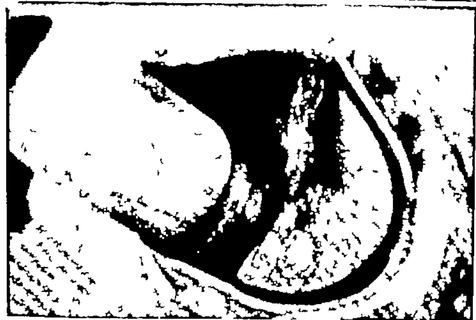


FIG 9 6 (*Upper*)—Exophytic nodular carcinoma with ulceration at site of partial denture pressure point.

FIG 9 7 (*Lower*)—Superficial carcinoma covered by advanced leukoplakia.

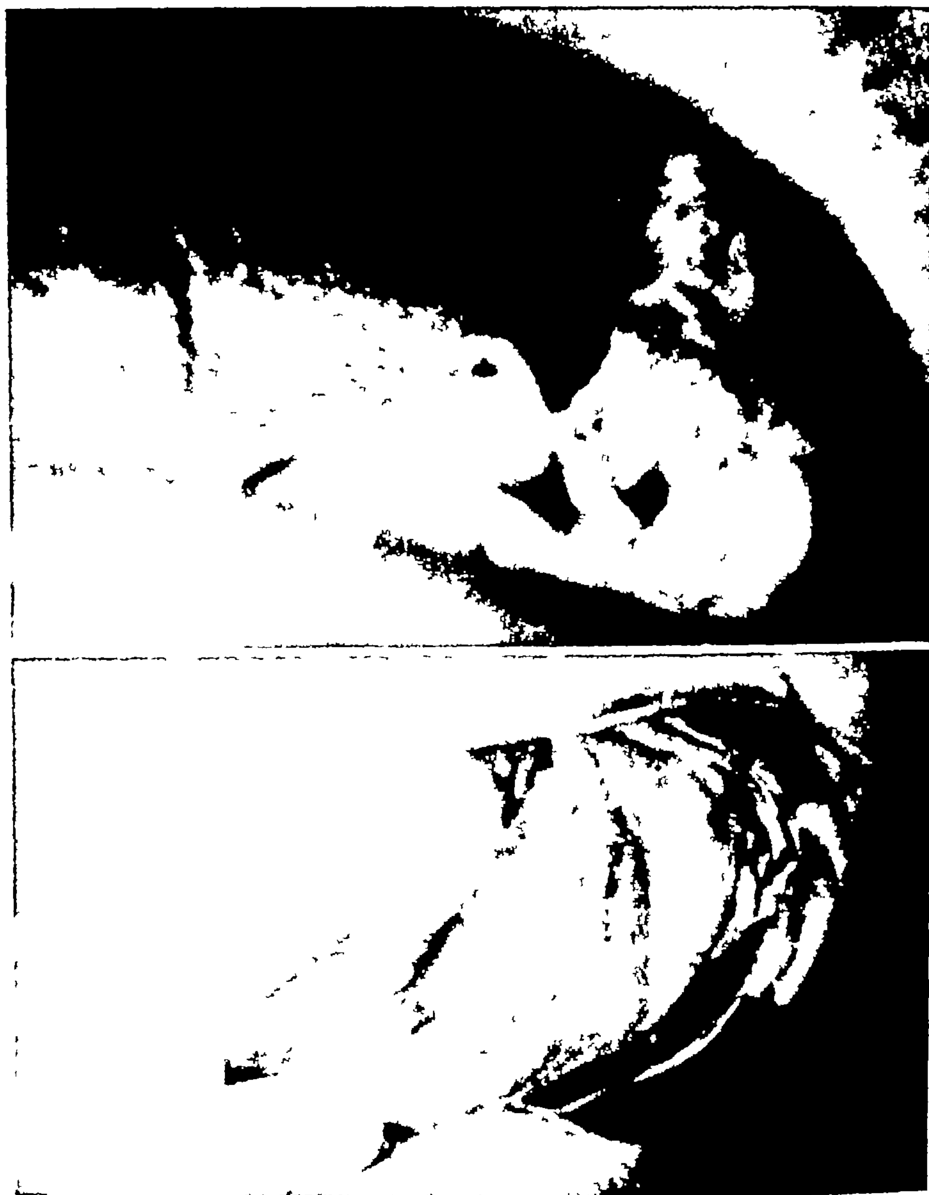


FIG 9 8 (*Upper*)—Extensive superficial carcinoma associated with advanced leukoplakia

FIG 9 9 (*Lower*)—Extensive carcinoma of the alveolar mucosa posteriorly with a thick, leukoplakialike, second primary lesion 1 0 cm anterior

constantly associated with leukoplakia Lymph nodes may be engulfed by the growing process but metastasis either to lymph nodes or to more distant structures is exceedingly rare

Exophytic Lesions Usually moderately elevated, coarsely granular and painless, these growths often spread along the surface and have plateaulike margins Moderate increase in erythema will be noted in such an area when compared to the contralateral locations of the mouth. Red granular tissue of punctate irregular shapes is frequently inter



FIG. 9 10—Nonulcerated carcinoma arising on the lingual surface of the gingiva.

spersed within a leukoplakic plaque. Moderate bleeding from minor trauma is present Local hygiene is poor and the tumor process may frequently fade into an area of true inflammatory gingivitis or gingivosis at the margin The situation would be of academic interest only were it not for the fact that such an acute gingival involvement by an inflammatory process may cause the examiner to overlook an early adjacent carcinoma. The surface of these lesions may be nodular warty or papillary These lesions spread to considerable size before ulceration or invasion, although early ulceration may appear where there are secondary dental traumatic factors. Lesions which have been neglected and allowed to attain a size of 2 cm frequently involve the underlying bone and often metastasize to cervical nodes

Endophytic Lesions It is difficult to differentiate these lesions in the early stages from less ominous ulcers Close inspection and delicate light palpation will frequently reveal a raised grooved margin with characteristic induration. This class of lesion is much more aggressive and close attention must be paid to the history Where duration of an ulceration



FIG. 9-11 (*Upper*)—Invasive carcinoma with destruction of alveolar bone and early invasion of the hard palate.

FIG. 9-12 (*Lower*)—Extensive ulcerous carcinoma with roentgenographic evidences of invasion of alveolar, palatal bone and maxillary antrum.





FIG 9 13 (*Upper*)—Carcinoma forming a deep ulcer with extensive invasion of the mandible and tissues of the cheek.

FIG 9 14 (*Lower*)—Ulcerous carcinoma with extensive invasion of the mandible and cervical nodes

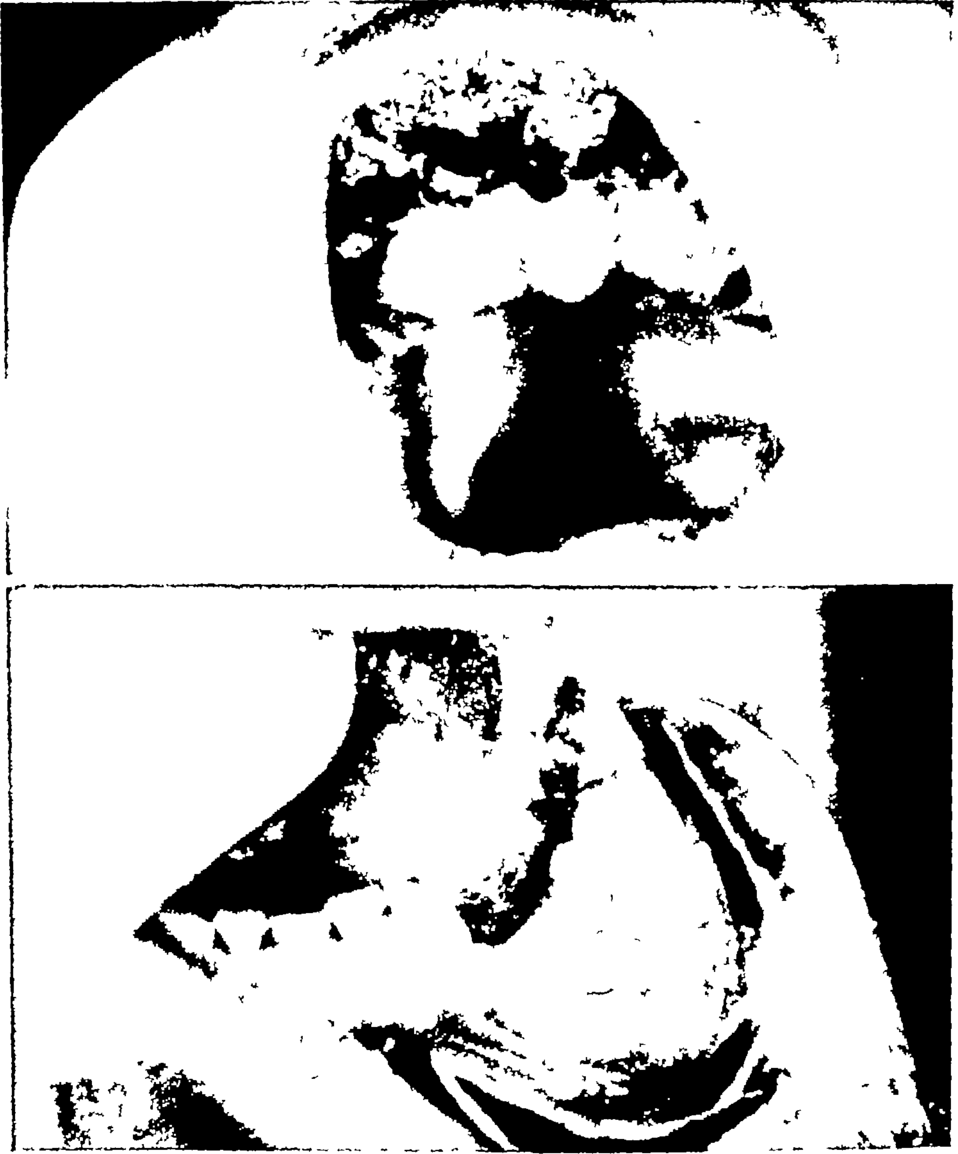


FIG. 9 15 (*Upper*)—Advanced ulcerous carcinoma with roentgenographic evidence of extensive invasion of the maxilla

FIG. 9 16 (*Lower*)—Sinus-tract carcinoma arising in the posterior drainage area of an osteomyelitis

is greater than ten days or where the history is vague as to duration pain or traumatic experience immediate biopsy for diagnosis is mandatory

Cervical Metastases Such metastases occur earlier and more frequently from mandibular lesions than from the maxilla. In both regions the dissemination via the lymphatics is much greater in the flat, ulcerous



FIG 9 17—The same patient shown in Fig 9 16 The mandible is extensively affected by osteomyelitis and only the cuplike area of bone destruction in the third molar region is due to carcinoma

(endophytic) lesion than in the exophytic carcinomas. In patients where there is a factor of chronic repeated trauma, either from prosthetic devices or unopposed teeth from an opposite arch occluding with gingival tissues metastatic spread may be earlier because of injury or infection superimposed in the primary lesion. From the mandible metastases appear most often in the submaxillary nodes less frequently in the facial nodes. From the maxillary gingiva, metastases occur equally between the submaxillary nodes and the upper deep cervical (jugular) chain. Following involvement of the submaxillary or facial nodes further dissemination to nodes in the neck is rapid. Metastatic involvement of the

ubmaxillary facial, or cervical nodes is found in 65 per cent of patients ith lesions of the mandible, and in 38 per cent of patients with lesions f the maxilla

)iagnosis

The biopsy procedure is the only dependable way of establishing or xcluding a diagnosis of carcinoma of the gingiva Hyperplasia of the



IG. 9 18 (*Upper*)—Carcinomatous infiltration of the alveolar bone around the oots of the molar teeth

IG 9 19 (*Lower*)—Carcinoma invading alveolar bone The crest is irregular nd lacelike, while only the coarse trabeculae remain

ingiva may arise on an infectious, mechanical, hormonal, or medicinal asis A number of benign tumors with wide variation in histology and rowth pattern may be observed Ulcers may be bacterial or viral or they ay have a mechanical origin Any painless overgrowth with a known uration of ten days or any growth with a vague history of onset should e considered cancer until proved otherwise Therefore, with few excep ions, which will be discussed under differential diagnosis, a routine ractice of performing a biopsy of gingival lesions as part of an initial xamination is strongly recommended.

A selection of the site for biopsy is more critical on the gingiva than elsewhere in the mouth. The biopsy should include a portion of the ulcer if present, a segment of the indurated border and a portion of the apparently normal tissue A description sent to the pathologist with such specimens should include specific location and clinical diagnosis. The



FIG 9 20 (*Upper*)—Carcinomatous invasion with fragments of bone scattered throughout the tumor

FIG. 9 21 (*Lower*)—Invasive and destructive carcinoma of the gingiva showing the irregular infiltrated margin.

pathologist appreciates a simple, diagrammatic drawing of the anatomic part and the relationship of the lesion to the part.

Treatment

The choice between the various methods of surgery and irradiation, or a combination of these procedures depends largely on the findings in the individual case The extent of invasion of the maxilla or mandible and the presence or absence of clinical evidence of metastasis to cervical nodes must be evaluated Because of the close proximity of the gingiva



FIG 9 22—A surgical specimen showing the contrast of both the osteolytic and osteoblastic carcinomatous changes produced in the bone



FIG. 9 23—Carcinoma which caused a multilocular defect with an almost complete division of the mandible in the cuspid area.

to highly vascularized bone and the continuity with other vital structures in the neck, the surgeon or radiologist is faced with a difficult problem in that the cancer may have invaded these structures

Prophylactic Oral Hygiene Appropriate measures should be instituted at once, and oral sepsis cleared up as promptly as possible. Gross calcific



FIG. 9 24—Carcinoma which has destroyed practically all the bone in the central portion of the body of the mandible.

deposits must be removed and chronic periodontal infections brought under control. Where acute infectious processes are present, the use of antibiotic therapy is justified. In addition, ill adapted prosthetic devices should be removed from the mouth, and rough fillings or teeth should be recontoured. Unopposed teeth which traumatize gingival tissues should be removed Extractions may be permitted prior to radiation therapy but are contraindicated in these areas following such therapy or prior to surgical treatment.

Treatment of the Primary Carcinoma To afford the patient the greatest chance of survival, the primary carcinoma of the gingiva is removed,

together with a wide zone of surrounding normal, soft, and osseous tissue For this reason, radical surgery is the method of choice The result may not prove entirely satisfactory from the cosmetic and functional points of view, but the advances being made in techniques of bone grafting and prosthetic replacements are overcoming these disadvantages



FIG 9 25–Surgical specimen of the mandible and contents of the neck en bloc

EARLY LESIONS Lesions of 1 5 cm in diameter, or less, have minimal invasion of the alveolar bone Careful roentgenographic studies with intraoral films from several angles should be made to determine the peripheral margins of invasion The procedure of choice is a partial resection of alveolar and cortical bone, including the mandibular canal this will preserve the continuity of the mandibular arch In the maxilla the floor of the antrum should be included in the block resection Other relatively early lesions extending beyond the boundaries of the gingiva require a much more radical operative procedure. In the mandible, a



FIG 9 26—Patient well twelve years after a partial resection of the mandible and a radical neck dissection for carcinoma of the gingiva



FIG. 9 27—Same patient as in Fig 9 26 showing the accurate occlusion which resulted from the bone graft

complete block section should be taken from the horizontal ramus and an immediate bone graft fitted in the defect for preservation of function Vertical surgical margins through bone must be at least 1 5 cm beyond the roentgenographically demonstrable evidence of disease Immediate x-rays of the resected bone will provide prompt information on the adequacy of the surgical margins



FIG 9 28—Same patient shown in Figs 9 26 and 9 27 twelve years after the bone-grafting procedure

In certain rare instances, early superficial exophytic growths may be destroyed by surface radium therapy or even by roentgen therapy The calculation of dosage and methods of application are similar to those described for carcinoma of the lip (Chap 6)

MORE ADVANCED CARCINOMAS OF THE GINGIVA Occasionally such carcinomas may be resected with the preservation of the ascending ramus of the mandible Immediate reconstruction with bone grafts may be indicated, or the ends of the mandible may be held in position by noncorrosive plates and external pin fixation The repair of the defect by a bone graft is accomplished six to eight weeks later The more common procedure, however, for advanced lesions is a resection of the mandible



Fig. 9 29—Carcinoma of the gingiva with extensive bone destruction which was treated with 200-kilovolt roentgen rays. The peroral and external portals were selected, and a dosage of 5600 tissue roentgens was delivered over a twenty two-day period.

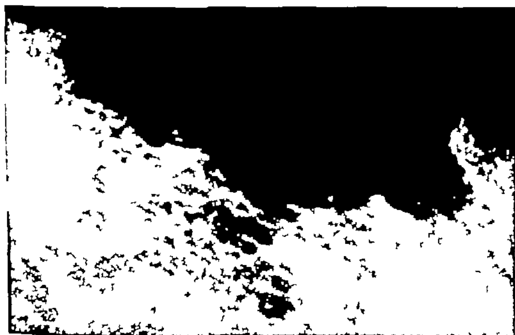


Fig. 9 30—Intraoral roentgenogram of the patient shown in Fig 9 29 The characteristic lacelike appearance of the invading margin is seen.

which includes disarticulation This procedure invariably results in deformity, but some degree of function may be maintained through preservation of the digastric muscle Frequently a large portion of the body of the maxilla must be removed, but rarely is it necessary to include the floor of the orbit The resulting aperture in the antrum and nares may be closed with prosthetic obturators



Fig 9 31—Same patient as in Figs 9 29 and 9 30 seven years after the radiation therapy Metastases did not develop

When cervical nodes are palpable at the initial examination they are considered to be involved The more radical procedure with a complete radical neck dissection should be performed with the en bloc removal of the primary and secondary tumor The prerequisites for such surgery are the same as for other lesions in the oral cavity When the disease has advanced beyond these conditions a degree of palliation may be accomplished by external and interstitial radiation

The Treatment of Cervical Metastases A radical neck dissection, whenever indicated is performed together with the surgery for the primary lesion Where surgical approach is not feasible, radiation can sometimes be used to deliver a carcinocidal dose In general however, either external



FIG 9 32 (*Upper*)—Extensive carcinoma of the gingiva with invasion of alveolar bone was treated with 200-kilovolt roentgen rays The peroral and external portals were selected, and 5400 tissue roentgens were delivered over a twenty six-day period.

FIG 9 33 (*Lower*)—Same patient as in Fig 9 32 showing the carcinomatous destruction of alveolar and cortical bone

or interstitial radiation to cervical metastases is classified as a palliative procedure Where metastases have developed subsequent to control of the primary disease, by either surgery or irradiation, the approach to treatment is surgical

Prognosis

Thirty-five per cent of patients with carcinoma of the gingiva (upper and lower combined) have a five-year survival rate The prognosis is somewhat better for the mandible, since the maxillary growths are less frequently discovered in an early stage

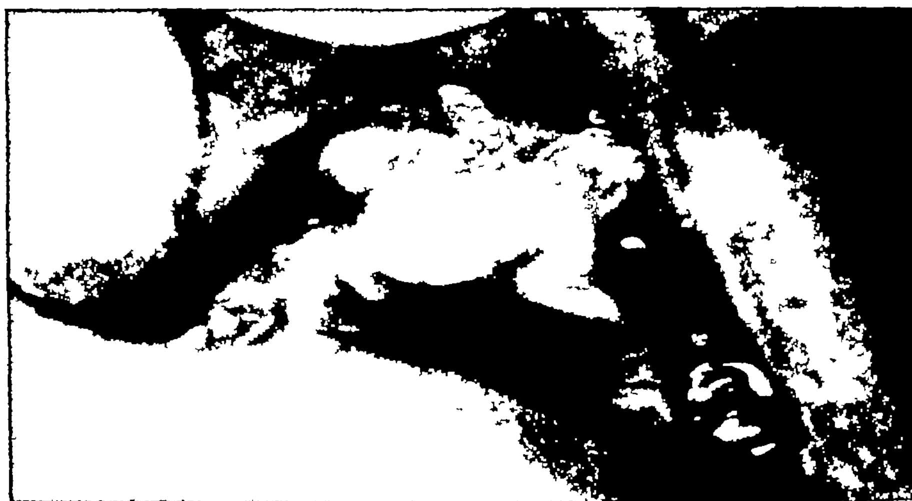


FIG 9 34—Same patient as in Figs 9 32 and 9 33 six years after the radiation therapy

DIFFERENTIAL DIAGNOSIS

The history is of inestimable value in making the differential diagnosis of any gingival lesion Thorough and complete examination of the entire oral cavity, as well as of the local site, is basic for the clinical differentiation between inflammatory and neoplastic processes Since certain abnormal conditions occurring on the mucous membranes are manifestations of systemic diseases or dermatoses, such a limited study should always be followed by a complete physical examination

Precancerous Lesions

Certain lesions and diffuse abnormal states of the gingival mucosa are frequently associated with carcinoma and in many cases precede its development Even chronic paradontosis when associated with leukoplakia may be a preconditioning state leading toward carcinomatous change The changes found in the mucous membranes of patients with oral cancer are (1) atrophy, (2) desquamation, (3) hyperplasia, (4)

leukoplakia (5) erythema, (6) pallor (7) partial xerostomia (8) heightened sensory response Systemic deficiency diseases such as sideropenia, Plummer Vinson syndrome simple achlorhydric anemia, and hypoproteinemia are the most commonly associated states concurrent with these early changes.

Leukoplakia An abnormal hyperplastic response of the mucosa toward extraneous stimuli this precancerous condition is not so common



FIG 9 35—Verrucous type leukoplakia covering the alveolar crest These precancerous changes are less marked on other oral surfaces

on the gingiva as on other oral surfaces but is associated in moderate frequency with partial or complete dentures and less often arises in the dentulous segments of mouths where oral hygiene is poor Leukoplakia is associated with at least 50 per cent of carcinomas arising in the mucosal covering of the alveolar ridge.

Abnormal Mucosal Atrophy of Systemic Etiology This is less readily detected on the gingiva than on other oral surfaces Where natural dentition is present, marginal erythema and thinning may be confused with acute or chronic gingivitis of local etiology However the characteristic stippling and moderate keratosis, normal on the labial aspect of the







FIG. 9-36 (*Upper*)—Localized leukoplakic plaque showed precancerous dyskeratosis, microscopically.

FIG. 9-37 (*Center*)—Chronic nonspecific inflammatory ulcer and osteomyelitis.

FIG. 9-38 (*Lower*)—Pseudopapilloma of traumatic origin.

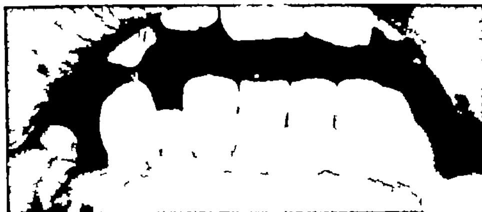






FIG. 9 39 (*Upper*)—Focal fibroepithelial hyperplasia

FIG. 9 40 (*Center*)—Fibroepithelial hyperplasia caused by denture irritation.

FIG. 9 41 (*Lower*)—Fibroepithelial hyperplasia with marked chronic inflammation.

The pregnancy tumor occurs in about 2 per cent of pregnant women and is usually a single growth appearing as an overgrown gingival



FIG 9 43—Localized gingivitis gravidarum, the so-called pregnancy tumor

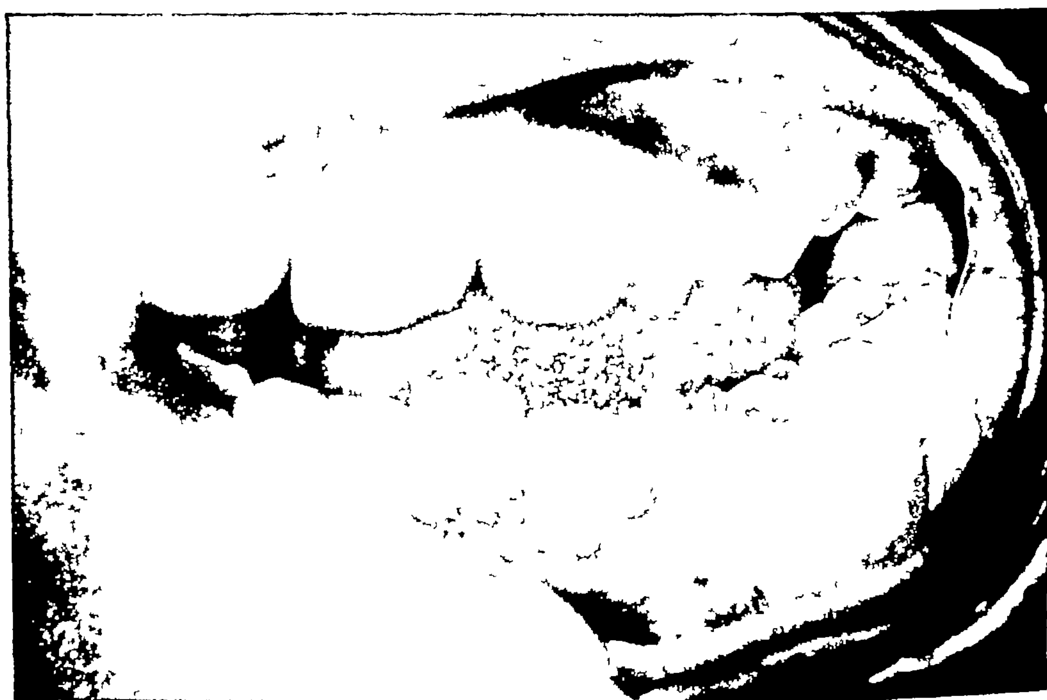


FIG 9 44—Adolescent hormonal hyperplastic gingivitis in a male child

papilla It may become sessile or pedunculated and eventually attains a size of 1 to 2 cm Usually it is either bright red or cyanotic in color, and if injured it may break down into a grayish necrotic ulcer This onset

may occur at any time during pregnancy growth may be rapid and associated with bleeding and mastication may be difficult.

Histologically the tissue changes in hyperplasia gravidarum and the pregnancy tumors are fundamentally the same, varying only in degree The stratum corneum becomes progressively thinner as pregnancy advances the rest of the mucosa becomes thicker and more edematous and the epithelial pegs extend deeper into the submucosa which is made up



FIG 9 45—Pyogenic granuloma with marked inflammation and associated with a root abscess.

of angiofibromatous tissue. The bulk of the pregnancy tumor is comprised of this latter component Without this history the pregnancy tumor is histologically indistinguishable from pyogenic granuloma

Surgical therapy is required when there is severe bleeding or interference with mastication Removal is best accomplished with a gingivectomy Cauterization of the base reduces chances of recurrence, and placement of surgical dressing packs retards the regrowth of the exuberant underlying tissue until complete epithelialization takes place. Recurrence is prompt when the treatment is too superficial These lesions usually regress spontaneously following parturition but some may remain and require surgical excision

Pyogenic Granuloma. This type of growth is a hyperplastic process, usually initiated by mechanical trauma and perpetuated by a nonspecific chronic infection The lesion is elevated, sharply demarcated, usually round in shape and may vary from a few millimeters to a centimeter

in size The surface is usually granular or mulberrylike, and in early stages the texture is soft, but with fibrous repair it becomes more firm These lesions never exhibit the induration characteristic of cancer Upon gentle manipulation they may bleed freely from the surface because of their vascularity Clinical differentiation from benign tumors and carcinoma of the gingivae is difficult The treatment is excisional biopsy for diagnosis and cure

Aphthous Ulcers (Canker Sores) Canker sores are caused by a virus which lies dormant within the mucosa and is activated by a number of systemic factors, as well as by local trauma Respiratory infections, gastrointestinal upsets, and allergic reactions are the most common causes The onset is marked by a sharp, tingling, burning pain a few hours before the appearance of a visible lesion When the lesion is fully developed, its center is eroded but does not bleed readily The ulcer is slightly depressed, but the margins are not elevated above the surrounding mucosa It is not indurated but is exquisitely tender to palpation The duration of a canker sore may vary from three days to two weeks, but a longer duration will be observed when either superimposed traumatic factors or concurrent bacterial invasions are present A small percentage becomes persistent from continued local overtreatment and simulates nonspecific ulcers Local applications of nonescharotic agents for relief of pain is the most acceptable treatment

Peripheral Giant-cell Reparative Granuloma Along with other pseudotumors and neoplasms, this growth has long been referred to as an epulis The traumatic lesion usually presents itself as a polypoid-shaped or even broad-based lesion along the alveolar crest The color may vary from dark red to pale, depending on the vascular and fibrous component Histologically, these tumors are similar to the central giant-cell reparative granuloma and the granulomas associated with hyperparathyroidism Differentiation from the latter may be furthered by complete roentgenographic study of the teeth with demonstration of persistence of lamina dura Completion of the differential diagnosis may require a complete physical examination and laboratory studies, including determination of blood calcium and phosphorus levels Further discussion of this granuloma will be found in Chapter 21

Pathologic Calcification of Soft Tissues Such calcification may be of either a dystrophic or a metastatic type In the dystrophic type the tissue has been altered by some process which has produced necrosis or hyaline changes before the calcification occurs In metastatic calcification the deposition of the calcium salts is in a previously unaltered tissue and is usually associated with a high blood calcium level caused by such conditions as hyperparathyroidism, prolonged renal failure, or metastatic skeletal carcinoma





Fig 9 46 (*Upper*)—Peripheral giant-cell reparative granuloma
Fig 9 47 (*Lower*)—Mucosal wart.



Fig 9 48—A so-called extraosseous osteoma

In the gingiva the calcific deposits have been explained as occurring either from fragmentation of dental structures (dentin-cementum remnants) or from the usual causes of dystrophic calcification The latter



FIG 9 49 (*Upper*)—Pathologic ossification, an extraosseous osteoma
FIG 9 50 (*Lower*)—Pathologic ossification, an extraosseous osteoma

view is more correct The calcification may be in dustlike particles but is more often in small aggregates The deposit may be sufficiently extensive to produce a gritty texture when the lesion is sectioned, but usually it is a microscopic finding only.

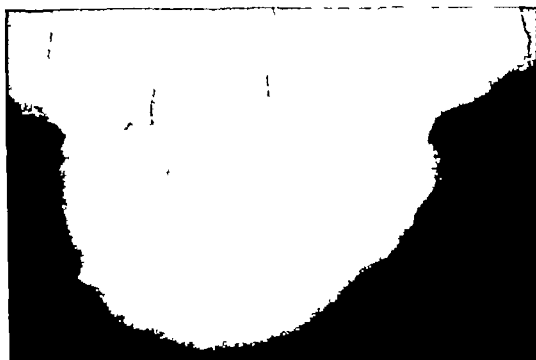


FIG. 9 51 (*Upper*)—Pathologic ossification, an extraosseous osteoma.
FIG 9 52 (*Lower*)—Pathologic ossification, a submaxillary gland osteoma.

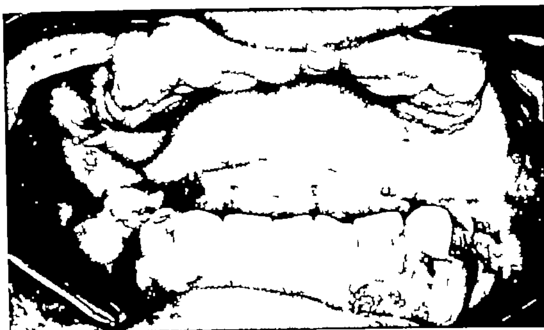
Pathologic Ossification Heterotopic bone is not uncommon as a sequela to dystrophic calcification, but osseous metaplasia can occur without previous calcification in damaged tissue undergoing repair The bone formed may be mature or immature The fibroblast has many of the potentialities of mesenchyme, and without evidence of cell division can become an osteoblast In the gingiva the most frequent lesions containing a roentgenographically detectable mass of heterotopic bone are the fibroepithelial hyperplasias and the giant-cell reparative granulomas Occasionally the bone may have a fatty or myeloid marrow Roentgenographically these extraosseous growths appear to be of uniform density with well-defined margins, not unlike those of osteomas The majority appear to be adjacent to the periosteum of alveolar bone, but others may be isolated by larger amounts of soft tissue The treatment consists of excision for diagnosis and cure

Noninflammatory Lesions

Fibrous Hyperplasia Characteristic of this lesion is an enlargement of the gingival tissues, with particularly prominent interproximal papillae and a cordlike thickening of the gingiva at and above the level of attachment The tissues are firm, dense, resilient, of normal color or slightly paler than normal, insensitive, and not easily traumatized Relatively few complaints are given Trauma is believed to be an inciting factor, but the underlying mechanism producing a fibrous tissue proliferation instead of inflammatory reaction is still not known The treatment consists of the removal of all local irritation, improvement in oral hygiene, and gingivectomy of any residual dense fibrous tissue

Congenital Macrogingivae A form of fibrous hyperplasia, this condition has been confused in terminology with fibromatosis gingivae, elephantiasis gingivae idiopathic fibromatosis, primary hypertrophy, and gingivoma or hereditary hypertrophy of the gingiva The etiology is not known, although a genetic factor, as well as a possible endocrine dysfunction, has been implicated Heredity in this condition seems to be established, as it is commonly associated with other hereditary defects such as hypertrichosis, feeblemindedness, and epilepsy The clinical feature is the marked enlargement of the gingiva, with partial or complete covering of the teeth The tissues are fibrous and resilient In infants the process may interfere with the eruption of teeth, and if so, the fibrous covering may remain intact Both upper and lower gingiva may be affected, and the chief complaint is usually the deformity

The histologic findings are the characteristically marked overgrowth of fibroblasts and dense collagen bundles There is an acanthosis with long rete pegs but atrophied superpapillary epithelium Treatment consists of gingivectomy although a recurrence may follow.



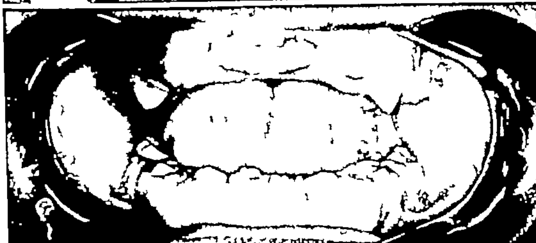




FIG 9 53 (*Upper*)—Congenital macrogingivae in male parent of four children. Two of the children (shown in Figs. 9 54 and 9 55) inherited this condition, without other hereditary defects

FIG. 9 54 (*Center*)—Macrogingivae in the male child of parent shown in Fig 9 53

FIG 9 55 (*Lower*)—Macrogingivae in female child of patient in Fig 9 53

Dilantin Gingivitis This is a specific fibrous hyperplastic response to the antiepileptic drug diphenylhydantoin sodium and its closely associated barbital derivatives With this history the diagnosis may be made without biopsy Microscopically, there is epithelial proliferation, moderate keratosis, varied elongation and widening of the rete pegs, and productive fibrosis of the connective tissue In addition, inflammation may be superimposed Substitution of other drugs for the management of epilepsy is advisable Routine peridontal procedures will then often control the gingival process, although gingivectomy may be required in some cases

Benign Tumors

Squamous Papillomas These growths arise as small, protruding, freely movable nodules, on either a narrow or a broad base The surface of the tumor is wartlike, and the color may vary from a granular redness to a gray-white, depending on the amount of hyperkeratosis Excisional biopsy for diagnosis and cure is usually adequate

Fibroma Actually the fibroma is a rare tumor However, what is commonly called a fibroma is usually the so-called fibroepithelial papilloma The diagnosis depends on the microscopic examination Cure is effected by excisional biopsy

Hemangioma Relatively rare and commonly congenital, hemangiomas are not infrequently associated with similar lesions of the head and neck They occur also in adults, but usually in adults they are abnormal responses to injury Because of their blood content, they have a reddish or bluish color and are soft and compressible Lymphangiomas are exceedingly rare in this location A more complete description of this tumor is found in Chapter 7

Granular-cell Myoblastoma (Granular-cell Neurofibroma) This lesion is common in the gingiva, although more often seen in the tongue, and occurs in both muscular and extramuscular sites These tumors may occur at any age but are more frequently observed between the third and fifth decades

The histogenesis is uncertain, but the evidence at present favors a neural rather than a muscular origin Microscopically, the cells are arranged in strands and fascicles The cells have a pink, granular cytoplasm surrounded by a delicate reticular or connective-tissue sheath, but discrete cells without a definite cytoplasmic order may be present The cells characteristically are diffusely or focally in intimate contact with the overlying epithelium Where this occurs, pseudoepitheliomatous hyperplasia is usually present, in varying degrees, and may be so marked as to resemble a squamous carcinoma Bone invasion does not occur, and ulceration is rare

The clinical characteristics are those of a small tumor The protuberance, slightly elevated, smooth or somewhat nodular rarely attains a size larger than 1 5 cm in greatest dimension The treatment for this nonencapsulated tumor is a wide excision for the pedunculated type whereas the more infiltrative type requires removal of the underlying periosteum.

Tumors of Minor Salivary Gland Origin These tumors appear on the gingivae infrequently The histopathology characteristics and treatment are similar to those given for other oral sites (see Chap 11)

Other Malignant Tumors

Squamous carcinoma is the predominant malignant tumor appearing on the gingiva Although others such as fibrosarcoma rhabdomyosarcoma, malignant lymphomas etc. are rarely seen all have certain characteristics in common i e., ulceration and bone destruction The final diagnosis can be made only by biopsy

Melanoma A rare primary or secondary tumor in the oral cavity melanoma most commonly occurs on the palate and maxillary gingiva Primary melanomas arise *de novo* in the oral cavity rather than from a pigmented nevus which is even more rare than the melanoma. They are coal black in color and usually ulceration is present Infiltration is evidenced by an elevated margin widening of the alveolar ridge or a convexity of the palate Such a growth is highly invasive and appears roentgenographically as an osteolytic process without evidence of new bone formation. When the disease is confined to the oral cavity whether or not regional nodes are involved, the treatment is a wide surgical resection of the primary lesion and a radical neck dissection Inoperable cases should receive palliative radiation and chemotherapy The prognosis is uniformly bad (see Chap 6)

Ameloblastoma This locally malignant epithelial tumor frequently arises from the gingival mucosa. It simulates other bone-destructive processes such as peripheral and central giant-cell reparative granulomas hyperparathyroidism, giant-cell tumors, follicular cysts and fibrous dysplasia. The diagnosis can be made only by biopsy (see Chap 4)

READING REFERENCES

ACKERMAN L. V "Verrucous carcinoma of the oral cavity" *Surgery* 23:670–678 (1948)

ALLEN A. C., and S SPITZ "Malignant melanoma A clinicopathological analysis of the criteria for diagnosis and prognosis," *Cancer* 6:1–45 (1953)

BALDRIDGE O L and C A. WALDRON "Malignant melanomas of the mouth," *Oral Surg Oral Med Oral Pathol.* 7:1008–1115 (1954)

BARNFIELD, W F "Pathological calcification in the gingivae," *Am J Pathol* 22 1307–1308 (1946)

BYARS, L T, and B G SARNAT "Congenital macrogingivae (fibromatosis gingivae) and hypertrichosis," *Surgery* 15 964–970 (1944)

CONLEY, J J "Treatment of tumors of inferior alveolus and mandible," *Ann Otol Rhinol & Laryngol* 61 62–82 (1952)

GLICKMAN, I "A basic classification of 'gingival enlargement,'" *J Periodontol* 21 131–139 (1950)

HINE, M K "Fibrous hyperplasia of the gingiva," *J Am Dent Assoc* 44 681–691 (1952)

MATTICK, W L, and D J MEEHAN "Carcinoma of the gum," *Surgery* 29· 249–254 (1951)

ORBAN, B "Gingival inclusions," *J Periodontol* 16 16–21 (1945)

QUICK, D "Treatment of intraoral malignant disease," in *Clinical Therapeutic Radiology,* U V Portmann, editor The Williams & Wilkins Company, Baltimore, 1950, pp 112–135

SHARP, G S, and R C WOOD "The treatment of cancer of the gums," *J Oral Surg* 8.185–203 (1950)

CHAPTER 10

Lesions of the Cheeks

Lesions of the buccal mucosa are not so common as those on the tongue or gingivae Their clinical appearance and behavior are different from those of other intraoral lesions so that they merit separate discussion Anatomic differences modify the treatment of these tumors

APPLIED ANATOMY

The cheeks are the walls of the oral vestibule and are divided into the mobile portion, which is formed by the *buccinator muscle* the posterior part, which is over the *masseter muscle* and the *parotid gland* which is interposed between the buccinator muscle medially and the skin laterally

The cheek is bounded above and below by the reflection of its mucous membrane onto the maxillae This reflection is often referred to as the buccogingival fold. The posterior boundary of the cheek is marked by the pterygomandibular fold, which is opposite the posterior ends of the upper and lower alveolar processes. Anteriorly the cheeks are continuous with the tissues of the lips although the arbitrary boundary is the labial commissure

The mucous membrane of the cheek is firmly fixed to the inner fascia of the buccinator muscle which prevents the formation of folds and irritation during closing of the jaws The texture of the mucous membrane is similar to that on the lingual surface of the lips and thinner than that covering the gingivae.

The body of the parotid gland is situated in the retromandibular fossa and extends anteriorly on the outer surface of the mandibular ramus and masseter muscle as a thin triangular structure The outer surface of the gland is quite superficial covered only by the superficial fascia and skin. On the outer surface of the masseter muscle Stensen's duct emerges from the gland to course anteriorly across the muscle to enter the mucous membrane of the cheek opposite the second upper molar tooth.

The so-called buccal fat pad lies between the masseter and buccinator muscles and continues posteriorly to fill the spaces between the other muscles of mastication Its function is chiefly mechanical, and it acts as a masticatory fat pad The lymphatic drainage is most commonly to the submaxillary, or more correctly the submandibular lymph nodes, although accessory lymph nodes are frequently found along the anterior facial vein, where initial involvement is frequent Infrequently, and later in the course of the disease, the submental and superior deep cervical lymph nodes are frequent locations of metastases

CARCINOMA OF THE CHEEKS

The prevention of cancer, as well as the prompt diagnosis of actual carcinomatous lesions, is of particular importance on the buccal mucosa The cheek is easily accessible, and a routine examination of the oral cavity, as previously stressed, should always include a close scrutiny and palpation of the entire buccal surface Recognition of the early carcinoma assures a good cosmetic and curative result

Incidence

Primary buccal carcinoma comprises 9 per cent of all intraoral squamous carcinomas Males are affected four times more frequently than females, although where the habit of betel or *buyo* chewing prevails, females predominate

Etiology

Chronic irritation is an important causative factor in the development of buccal carcinoma Numerous agents have been named, but proof of their importance is often lacking The exact nature of the irritation is not so important as the chronicity of the process, which may account for the predominant location of buccal carcinoma at the level of the occlusal plane

1 *Dental traumas*, especially chronic minor injury to the mucous membrane due to rough or jagged teeth, projecting fillings, or ill-fitting dentures, are important coexisting factors
2 *Oral sepsis* is a frequent accompaniment of carcinoma
3 *Dietary deficiencies* with irritative mucous membranes are invariably observed with carcinomatous changes
4 *Tobacco smoking* is a form of chronic irritation The direct chemical contact with the mucosa by chewing tobacco, or use of snuff, is an even more potent factor

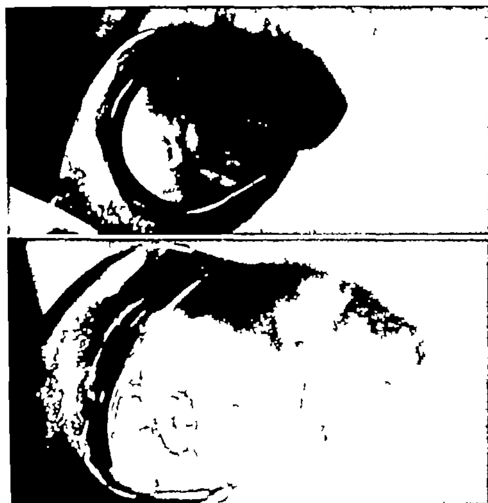


FIG. 10 1 *(Upper)—An area of fibroepithelial hyperplasia of the gingiva along the anterior margin of which there is a small, fissurelike leukoplakic lesion nearly 1 cm in diameter in the buccogingival groove Induration was demonstrated on palpation, and the biopsy excision revealed carcinoma in the buccal mucosa*

FIG 10 2 *(Lower)*—Papillomatouslike carcinoma with superficial invasion arising on an abnormal mucous membrane. Precancerous changes were shown microscopically anterior to the lesion

Histopathology

1 Lesions of the buccal mucosa are most frequently squamous carcinomas, Grade I or II, with the exception of a few adenocarcinomas arising in glandular appendages.
2 Carcinoma of the mucous membrane of the cheeks is morphologically and histologically similar to carcinoma of the lips
3 Leukoplakia accompanies carcinoma at this site more frequently than on any other oral surface



FIG 10 3—Small craterlike carcinomatous ulcer arising in an area of leukoplakia.

4 Lesions occurring anterior to the buccinator muscle are of lower grade and less aggressive than those overlying this muscle, where early invasion and metastases are common

Clinical Characteristics

Carcinoma of the buccal mucosa originates more frequently in the middle third of the cheek, halfway between the commissure of the lips and the pterygomandibular fold along the line of occlusion. Multiple primary growths are occasionally seen.

The clinical appearance may be described in two forms exophytic or papillary, and endophytic, or ulcerous, lesions

Exophytic, or Papillary Such growths more often develop in areas of leukoplakia The spread along the surface is usually much more extensive



FIG. 10 4 (*Upper left*)—Craterlike carcinomatous ulcer with extension superficially over the upper and lower lips

FIG. 10 5 (*Upper right*)—Superficial exophytic carcinomatous ulceration arising in an irritative atrophic mucous membrane

FIG. 10 6 (*Lower*)—Fine granular carcinomatous ulcer in the lower half of the buccal surface surrounded by a completely altered mucous membrane and showing precancerous characteristics, microscopically

than invasive This probably accounts for the relatively late involvement of cervical nodes

Ulceration or erosion is present, and the surface shows a fine granular appearance The margins are well defined, rolled, and indurated, induration of the base is dependent on the depth of invasion

Endophytic, or Ulcerous These lesions are the usual form of growths in the posterior area, although they do occur anteriorly The smaller

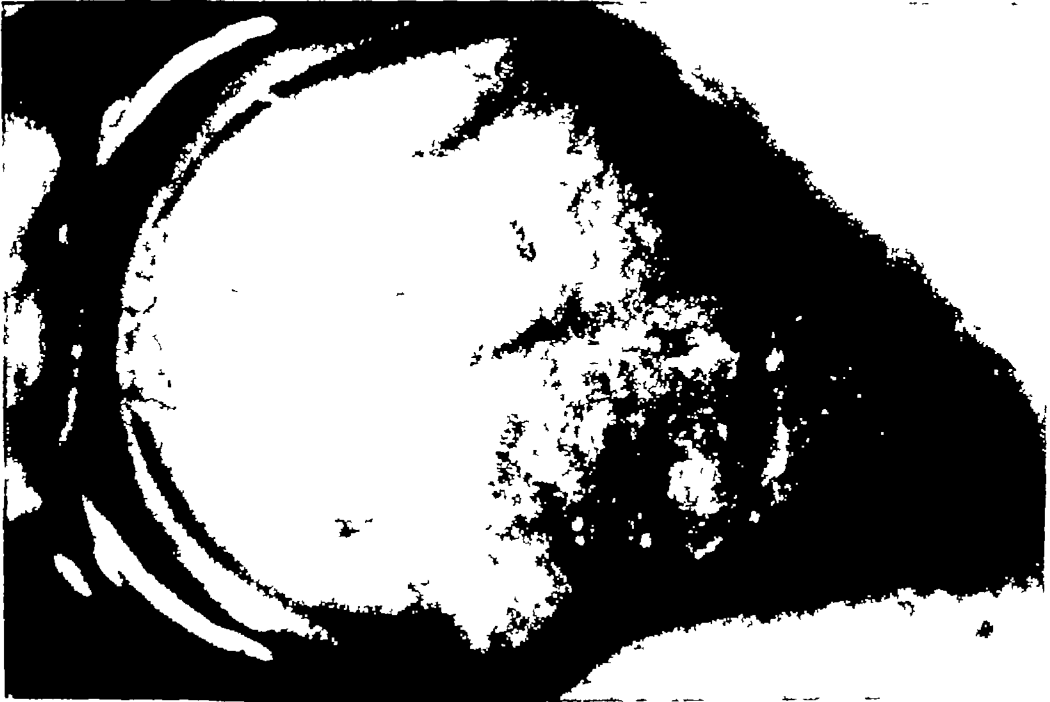


FIG 10 7—Mucoepidermoid carcinoma involving the posterior third of the cheek, with extensive infiltration and early invasion of the gingiva

lesions are well-circumscribed, indurated ulcers The craters have a punched-out appearance, and the margins are elevated Palpation will demonstrate fixation to underlying structures

In the more advanced stages, deeper invasion of muscle takes place, and varying degrees of trismus are present In recurrent and late cases, invasion of the jaws takes place

Metastatic Involvement of Cervical Nodes Such involvement, secondary to carcinoma of the buccal mucosa, occurs somewhat later than on other intraoral surfaces

Diagnosis

1 All abnormalities of the buccal surfaces should be considered carcinoma until proved otherwise by biopsy
2 The biopsy procedure is carried out on the initial examination, and one or more specimens are taken of the areas under suspicion







FIG 10 8 (*Upper left*)—Evertive carcinomatous ulcer involving the anterior third of the cheek and commissure of the lips

FIG. 10 9 (*Upper right*)—Advanced carcinomatous ulceration invading the full thickness of cheeks as well as early infiltration of both upper and lower lips

FIG. 10 10 (*Lower*)—Multiple carcinomas arising on an abnormal oral mucous membrane with both leukoplakic and atrophic changes

3. Leukoplakia is commonly observed on the buccal surfaces, and any associated ulcer, thickening, fissure, or nodule should be biopsied.

Treatment

In view of the variable characteristics, degree of malignancy, site of origin, and clinical course, it is not possible to follow a uniform plan in the treatment of carcinoma of the buccal mucosa. No one single procedure, whether it be surgery, different methods of radiation, or a combination of these techniques, can be applied to all cases. Treatment is dependent on the size and location of the primary lesion, the extent of invasion, and the possible involvement of regional lymph nodes.

Prophylactic Oral Hygiene. Measures should be instituted promptly. Particular attention should be directed to specific sources of irritation such as protruding, jagged, sharp teeth, ill-fitting dentures, and inflammatory processes of the oral mucosa. Carcinoma of the buccal mucosa rarely develops without gross oral sepsis and leukoplakia.

Treatment of the Primary Growth. In selected cases, surgery or radiation may be used. Both forms of therapy are equally successful in skilled hands.

Small primary growths of 2.0 cm in diameter, or less, may be treated by radiation. Peroral roentgen is a method of choice, and careful calculations of the time dosage give successful results without disfigurement.

Surgical removal is also feasible for this group of lesions, providing the line of excision is 1.5 cm away from the margin of growth. Excisions of greater areas invariably require some degree of plastic repair.

Moderately Advanced Lesions. Radiation is used advantageously for lesions of 2.0 to 3.0 cm in size. Roentgen therapy is preferable and may be applied with both peroral and external cones. The total tumor-tissue roentgen dosage is administered in this crossfire manner without risk of protracted healing.

Surgery may provide the only chance for effective control when the growth has involved the muscle, maxilla, or mandible. Resection of the cheek and invaded jaw is frequently required. An immediate plastic reconstruction can be performed only when it is possible to cover both the mucosal and skin surfaces. Internally, split-thickness grafts are satisfactory for epithelization of the buccal surfaces, and when the entire thickness of the cheek must be removed, this form of replacement is supplemented either with sliding full thickness or two grafts.

Far-advanced Primary Lesions. Palliative roentgen therapy is used in such cases.

Cervical Node Metastases. Radical neck dissection is the best treatment. When the treatment of the primary growth is accomplished by radiation, the surgery should be delayed until the active therapy has

been completed. Then classical radical neck dissection is performed, with the inclusion of all accessory facial nodes When the primary lesion is treated surgically a combined resection of the buccal growth with the contents of the neck on the affected side is recommended.



FIG 10 11 (*Left*)—Advanced infiltrative carcinoma involving the cheek and the upper and lower lips Roentgen therapy with 200-kilovolt technique was used to deliver 2100 tissue roentgens over a period of twelve days in addition 2100 gamma roentgens was administered from interstitial radium needles over a two-day period, for a total tumor dose of 4200 tissue roentgens

FIG 10 12 (*Right*)—Same patient as shown in Fig. 10 11 eight years after radiation therapy

Inoperable cervical node involvement is treated by external and interstitial radiation.

Prognosis

Buccal carcinoma receiving proper therapy early in the disease has a better prognosis than intraoral carcinoma in general Unfortunately the majority of buccal carcinomas average 3.0 to 3.5 cm in diameter at the

time of diagnosis, and a considerable number are situated in the posterior third of the cheek, with muscle involvement At this stage and in this posterior location the five-year controls total only 10 per cent In an all-inclusive group early or late, irrespective of location, a 25 per cent survival for five years without recurrence of disease may be expected

DIFFERENTIAL DIAGNOSIS

Precancerous Lesions

An unhealthy mucous membrane with irritative and atrophic changes, commonly present in persons past middle age, is of high clinical importance. Actual lesions of leukoplakia, scars, benign ulcers and tumors, as well as of carcinoma, are commonly encountered in such mouths Thus, a clinical relationship between these abnormal mucous membrane states exists, and actual transition into carcinoma has been proved



FIG. 10 13—Advanced leukoplakia involving the midportion of the cheek from the commissure posteriorly The most advanced stage is opposite the occlusal surfaces of the teeth and fades out in all directions

Leukoplakia When one considers the three clinical forms of leukoplakia, the incidence of this lesion on the buccal surfaces is higher than in any other region of the oral cavity In the most superficial or earlier forms, leukoedema appears as a thin, whitish film and is very commonly observed in smokers The other common lesion, however, is the linear hyperkeratosis, which develops on the level of the occlusal surfaces The least common and yet the most significant stage with respect to carcinoma is the more advanced thickened whitish layer which may appear localized in plaquelike formation, or more generally with linear striations and/or a fenestrated effect The surfaces are usually irregular because of varying degrees of hyperkeratosis, papillation and even superficial ulcerous craters are commonly observed This latter state invariably requires biopsy of the areas under suspicion

ETIOLOGY Causes are similar to those of leukoplakia on other oral surfaces, with emphasis on dental trauma and the use of tobacco The absence of a tooth in the dental arch, rough or badly fitting dentures or

fillings, as well as faulty contact between the upper and lower teeth are inciting factors for local lesions Chewing tobacco is specifically incriminated when leukoplakia develops at the site where the quid is held and the lesion clears up with the discontinuance of the habit.

Histopathology Leukoplakia varies in its histopathology from a slight degree of hyperkeratosis in the diffuse filmy variety to precancerous



FIG. 10 14—Advanced and generalized precancerous leukoplakia with well developed keratotic plaques and early papillomatous formation.

changes. The linear hyperkeratosis opposite the occlusal surfaces of the teeth is a more formidable lesion and may even show papillomas and fissures with precancerou histologic changes The advanced form shows not only a marked degree of hyperkeratosis but acanthosis and dyskeratosis.

Treatment Early diffuse leukoplakia is notably improved if not entirely cleared up through the elimination of the irritants adequate oral hygiene



Fig. 10 15 (*Upper*)—A completely abnormal mucous membrane in a regional area of the oral cavity covering the posterior third of the cheek, the gingiva, and the left side of the soft palate Precancerous leukoplakia is present on the buccal and palatal surfaces

Fig. 10 16 (*Lower*)—Small pseudopapilloma covered by precancerous leukoplakia arising on an abnormal, irritative, and atrophic mucous membrane



FIG 10 17 (*Upper*)—Lichen planus a classical fenestrated type of hyperkeratosis covering the posterior third of the buccal mucosa.

FIG. 10 18 (*Lower*)—Chronic inflammatory ulcer of several months duration arising in an abnormal mucous membrane presenting evidence of leukoplakia and atrophy

and dietary and vitamin therapy Biopsy of the advanced leukoplakic lesions is imperative to determine precancerous as well as possible early cancerous changes Conservative therapy may be tried for a short interval, if there is no improvement, excisions with primary closure or even split-thickness grafts are very satisfactory procedures to avoid subsequent cancerous changes



FIG 10 19—Chronic inflammatory, eroded and partially ulcerated lesion involving the upper half of the buccal surface in a patient with a long history of irritation and burning of the oral surfaces, associated with achlorhydria

Abnormal Oral Mucous Membranes This condition is most frequently encountered in the upper-age group and is shown as an atrophic irritative surface which is not able to withstand the average trauma Dietary dyscrasia from faulty protein metabolism, vitamin-B deficiency, and or abnormal hormonal balance play a definite but not yet clearly understood role

Inflammatory Lesions

Simple inflammatory ulcers are most commonly herpetiform lesions (canker sores) In addition, the shallow, gangrenous ulcers of moniliasis (thrush) are observed, as well as various granulomas and nonspecific ulcers which resemble lesions on other oral surfaces The buccal mucous membrane is particularly susceptible to chronic irritation, and specific

therapy should be given such areas for a short period If satisfactory response is not achieved all ulcers should be excised for biopsy as well as cure





FIG 10 20 (*Upper*)—Fibroepithelial papilloma of traumatic origin

FIG. 10 21 (*Lower*)—Pseudopapilloma of traumatic origin which has been partially bisected by the buccal flange of the denture.

Benign tumors

Benign tumors are common in the cheeks and separate description is not justified except for the establishment of a positive diagnosis

1 A *papilloma* is rarely encountered, but its irritative counterpart, the papillomatous epithelial hyperplasia from mechanical irritation, is a



FIG 10 22 (*Left*)—Fibroma consisting entirely of connective tissue without inflammation

FIG 10 23 (*Right*)—Hemangioma of a dome-shaped, reddish-blue color is covered by normal mucous membrane and has a well-defined margin with only slight invasion



FIG 10 24—Cystic hygroma involving the full thickness of the cheek







FIG 10 25 (*Upper*)—A white spongy nevus of the buccal mucosa.

FIG. 10 26 (*Center*)—Lymphatic leukemic infiltrate

FIG 10 27 (*Lower*)—Mucoepidermoid carcinoma of minor salivary gland origin in the posterior third of the cheek with invasion of the mandible

common lesion and for both lesions the possible inciting factor should be rectified and the growths excised

2. A *fibroma* may be rarely encountered in the substance of the cheeks as a well-circumscribed encapsulated nodule arising from connective-tissue stroma. Excision is required for a conclusive diagnosis
3. A *lipoma* is a rare tumor in the cheeks Lipomas usually originate from the fatty tissues of the suctorial pad (corpus adiposum buccae) These tumors are well circumscribed, and simple surgical excision is rarely difficult
4. *Hemangioma* is a benign vascular tumor arising not infrequently in the submucosa from trauma or as an exceedingly rare tumor in the deeper structures of the cheek The appearance in this location simulates in every respect that on the lip
5. *Salivary gland tumor* rarely develops in the minor salivary glands of the mucosa of the cheeks, but is common in the parotid and occurs occasionally in the so-called molar glands around the orifice of Stensen's duct

Other Malignant Tumors

Other malignant tumors which occur at this site are exceedingly rare and include melanomas, rhabdomyosarcomas, and fibrosarcomas In order to obtain a proper diagnosis, a biopsy must be made

READING REFERENCES

BREED, J E "Epithelioma of the buccal mucosa," *Am J Roentgenol Radium Therapy Nuclear Med* 72 806–812 (1954)

JACKSON H S, and G B NEW "Carcinoma of the buccal mucosa treatment and end results *Surg Gynecol Obstet* 91 232–241 (1950)

MACFEE W F "Full thickness defects of cheek (cancer) involving angle of mouth methods of repair" *Surg Gynecol Obstet* 76·100–105 (1943)

MARTIN H E and O H PFLUEGER "Cancer of the cheek (buccal mucosa), study of 99 cases with results of treatment at end of five years" *Arch Surg* 30,731–747 (1935)

MODLIN, J, and R E JOHNSON 'The surgical treatment of cancer of buccal mucosa and lower gingiva, *Am J Roentgenol Radium Therapy Nuclear Med* 73 620–638 (1955)

SANSTEAD H R and J W LOWE 'Leukoedema and keratosis in relation to leukoplakia of the buccal mucosa in man' *J Nat Cancer Inst* 14 423–433 (1953)

CHAPTER 11

Lesions of the Hard and Soft Palate

The hard and soft palate combine to form the roof of the mouth. For this reason, in the present chapter the two surfaces are considered together despite the fact that growths arising on the hard palate differ from those on the soft palate as greatly as tumors of the lip differ from those on the tongue.

APPLIED ANATOMY

The palate separates the oral cavity from the maxillary antra and nasal spaces and extends from the border of the attached gingiva to the posterior margin of the soft palate.

The hard palate contains a bony plate consisting of the palatine processes of the maxilla and the horizontal plates of the palatine bone. The hornified masticatory mucous membrane includes a dense lamina propria. In some areas fat and minor salivary glands are interspersed between the cross striated collagenous fibers Structurally the hard palate may be divided into three zones (1) the peripheral zone is most like the loose gingival mucosa firm resistant, smooth and continuous with the dense gingiva In this area there is apparent division between the lamina propria of the mucosa, submucosa, and periosteum In the anterior portion the incisal or palatine papilla can be seen immediately behind the upper central incisors It covers the oral opening of the nasopalatine canals. (2) The central zone includes the palatine ridge which extends from the papilla down the center of the palate to its posterior extremity In the anterior portion radiating from the incisal papilla and parts of the palatine raphe, irregular branching ridges cross the palate These palatine rugae consist of dense firm connective tissue with cornified epithelium (3) In the wide intermediate zones between the palatine raphe and the peripheral area, the mucosa is firmly fixed to the periosteum of the palate even though there is a well-differentiated zone of submucosa. This fixation of mucosa to periosteum is by means of strong,

tight strands and bands of inelastic connective tissue interspersed with fat or glands

The soft palate is a fold of mucous membrane containing an intricately arranged musculature of its own The protective mucous membrane on the oral surface is a stratified squamous epithelium, much thinner than that of the hard palate, and not cornified In the structure of the soft palate are included connective tissue and numerous large and densely packed seromucous glands The lateral margin extends to the posterior boundary of the cheek, namely, the pterygopalatine fold There are so-called arches the lateral or palatoglossal (anterior palatine) pillar, and the more medial palatopharyngeal (posterior palatine) pillar Between these pillars the palatine faucial tonsil is located The free border of the soft palate is doubly concave and extends into the midline to the palatine uvula At the free posterior border the oral mucous membrane is continuous with the nasal mucosa, which is pseudostratified ciliated columnar epithelium Infiltration of the soft palate, by causing interference with the musculature results in marked disability in swallowing and speaking

The lymphatic drainage from the anterior part of the hard palate is through the anterior facial lymph vessels into the submaxillary and upper deep cervical nodes This is the same drainage as for the body of the tongue The posterior part of the hard palate and all of the soft palate drain posteriorly along the branches of the posterior facial vein into the anterior-superior deep cervical lymph nodes, the same group of nodes that drain the base of the tongue and the posterior sublingual region

CARCINOMA OF THE HARD AND SOFT PALATE

Malignant tumors differ in their clinical and histological appearance, as well as in prognosis, depending on the region of the palate involved Epidermoid carcinoma arising in the mucosa and other carcinomas having their origin in the seromucous glands comprise the two chief varieties of palatal cancers

A thorough examination of the palate posterior nasal space, and sinuses, together with careful roentgenographic study is essential in differentiating conclusively between tumors arising in the palatal mucosa and those spreading from the maxillary antrum or nasal cavity Approximately 30 per cent of involvements of the palate are secondary extensions of a primary growth in the gingiva the maxillary antrum, the tonsil or the tongue

In every part of the oral cavity early diagnosis of carcinoma is of vital importance Nowhere however is it of greater urgency than in affections

of the palate. Early detection of cancer in this location may save the patient from an aperture between oral and nasal cavities On the other hand, a missed diagnosis may mean that an advanced growth in the soft palate will result in a permanent dysfunction with liquids and foods entering the nose

Incidence

Primary squamous carcinoma of the hard and soft palate accounts for 10 per cent of these tumors in the oral cavity Males are affected nine times more frequently than females and the average age at detection is sixty two years

Etiology

The degenerative changes in the palatal mucosa are well demonstrated in older individuals with epidermoid carcinoma. The chronicity of certain inciting factors in these patients is also obvious.

Nothing is known of the causative factors of tumors of the minor salivary glands

Tobacco Habits Frequently mentioned in histories tobacco habits are of great importance in the development of leukoplakia. However the incidence of carcinoma of the hard and soft palate associated with advanced leukoplakia is considerably lower than in other intraoral locations Nevertheless the development of leukoplakia is a warning that abuses are being practiced, and such excesses as heavy pipe and cigar smoking and the chewing of tobacco should be discontinued

Trauma Mechanical chemical or thermal trauma frequently produces visible lesions of the palate. The posterior margin of the hard palate is the area most often involved with carcinoma associated with mechanical injury from dentures. The mechanical trauma of negative pressure created by excessive relief of the palate of a denture however has a remarkably low relationship to carcinoma. Chemical trauma is most frequently caused by the impregnation of palatal dental appliances with tobacco products and results in a diffuse leukoplakia and/or carcinoma Thermal trauma is produced by the injudicious habitual use of scalding liquid foods and may have results similar to those produced by chemical trauma.

Histopathology

Carcinoma of the hard palate is well differentiated, while that occurring in the soft palate is of a higher grade In the hard palate with its dense submucosa and bony structure lesions spread centripetally Invasion of bone is relatively late with subsequent invasion of the maxillary

sinus and nasal cavity often long deferred The carcinoma of the soft palate is characteristically less bulky and early invades contiguous structure including the hard palate

Clinical Characteristics

Epidermoid carcinoma occurs three times as frequently on the soft as on the hard palate The posterior edge of the soft palate is the most commonly involved area, only rarely is the uvula involved The reverse is true for salivary gland tumors which are more commonly found on the hard than on the soft palate (2 1)

1 The exophytic type is usually not observed on the hard and soft palate The papillary form, when present, has an irregular granular surface, it spreads superficially, with little invasion
2 The endophytic type appears almost invariably as a craterlike or punched-out ulcerous lesion with rolled, indurated margins
3 Bulky nodular tumors are usually of minor salivary gland origin, and ulceration suggests carcinomatous change
4 The growth activity of carcinoma of the hard palate is generally slower than on other surfaces This may be in part because of the low grade of such lesions and also because of the barrier which the dense periosteum and cortical bone provide Not infrequently these tumors attain a considerable size before they are discovered
5 Pain and soreness are early symptoms of carcinoma of the soft palate Later the tumor causes dysphasia, impairment of speech, and trismus
6 Cervical metastases are less frequent in cases of primary carcinoma of the hard palate than of the soft palate (1 2) When carcinomas of the hard and soft palate are considered together, metastases are present in 45 per cent of all cases on initial examination Subsequently, an additional 15 per cent may develop metastasis The total of 60 per cent metastases in primary carcinoma of the palate approximates that of carcinoma of the tongue or cheek

Diagnosis

Diagnosis of carcinoma of the palate is usually retarded apparently because few subjective symptoms are present in early stages The average diameter of primary lesions on admission of the patient varies from 3 5 to 5 0 cm

The early recognition of these growths is obviously important in avoiding, if possible the complicating permanent foramina between the oral cavity and the nares or maxillary antra, and the loss of part or all of the soft palate

Secondary direct invasion of the palate from carcinoma of the antra



FIG 11 1—Classical crateriform carcinoma 5 mm in diameter associated with leukoplakia.



FIG 11 2—Minute carcinomatous ulcer in an area of advanced leukoplakia at the junction of the hard and soft palate The abnormal mucous membrane is regionally confined to the area where the leukoplakia is more advanced, and a Z-shaped erosion is visible on the lingual surface of the gingiva.



FIG. 11-3—Superficial carcinomatous lesion partially covered and surrounded by advanced leukoplakia over the soft palate, commonly associated with heavy pipe smoking.



FIG. 11-4—Carcinomatous ulceration over the left hard palate and gingiva. Extensive bone destruction without gross tumor invasion of the antrum was demonstrated roentgenographically.



FIG 11 5 (*Upper*)—Minute carcinomatous ulcer on the surface of a small torus palatinus.

FIG 11 6 (*Lower*)—Small carcinomatous ulcer at the junction of the soft palate and buccal mucosa, which was probably incited by denture irritation.

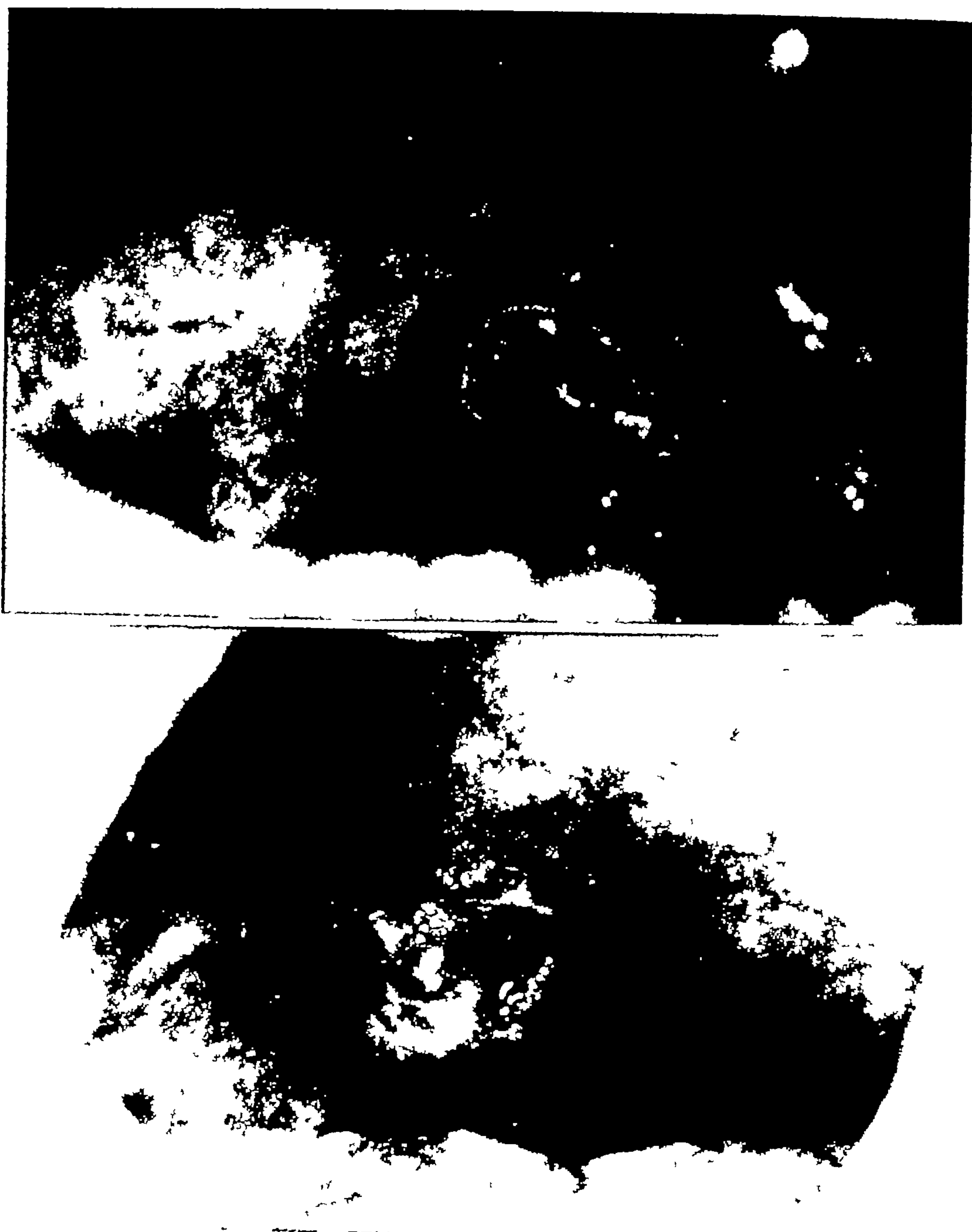


FIG 11 7 (*Upper*)—Minute nodular carcinoma along the free margin of the soft palate associated with abnormal atrophic mucous membrane which is sufficiently thin to permit visualization of the vascular network

FIG 11 8 (*Lower*)—Fine granular carcinomatous ulcer of the uvula.

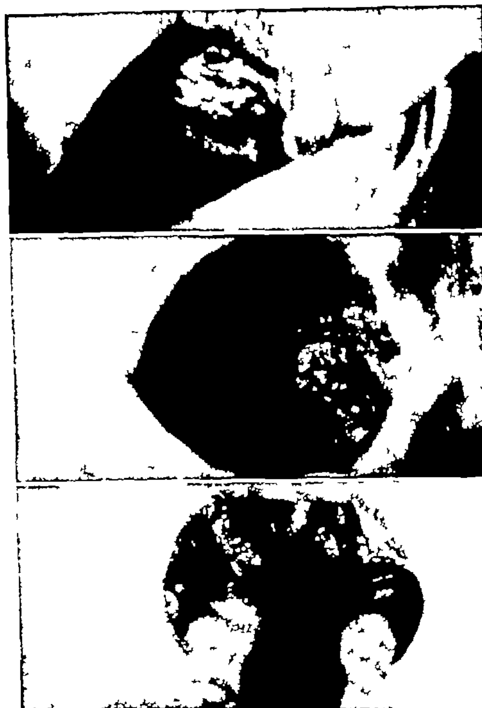


FIG 11 9 (*Upper*)—Evertive carcinomatous growth with direct invasion of the tonsil and the pterygomaxillary fossa.

FIG 11 10 (*Center*)—Carcinoma of the soft palate with extensive invasion of the tonsillar fossa, pterygoid muscle, and fixation to the ascending ramus of the mandible.

FIG 11 11 (*Lower*)—Anaplastic carcinoma which has destroyed the central portion of the soft palate and invaded the right tonsil.



FIG 11 12—Carcinoma of the antrum invading the hard palate and alveolar ridge to form a convex swelling

or nares may appear as a bulge of the palate or as an actual ulceration on the palatal surface A thorough physical examination with careful roentgenographic studies is essential to differential diagnosis

Treatment

Prophylactic Oral Hygiene This is a basic prerequisite to treatment Complicating infections in bone or maxillary antrum should receive preliminary chemotherapy

Treatment of the Primary Growth Surgical treatment is used for the hard palate, and irradiation for the soft palate

HARD PALATE Early lesions with very little invasion can be readily excised The mucoperiosteum and often the underlying bone must be included in the specimen Advanced lesions with roentgenographic evidence of palatal involvement require resection of the entire maxilla below the level of the infraorbital vessels In far-advanced growths with tumor tissue in the antral cavity as the result of direct extension through the hard palate it is invariably necessary to perform a complete resection of the maxilla with inclusion of the contents of the orbit

The lesser palatal defects may then be relieved by prostheses so that functional disabilities in speech eating and drinking no longer present a problem If a few sound teeth can be preserved in the upper jaw, such devices can be held firmly in place In the edentulous upper jaw, retention of an appliance necessitates the construction on the denture



FIG 11 13 (*Left*)—Bulky advanced adenocarcinoma involving the left soft palate with direct invasion in the tonsil and fixation to the ascending ramus of the mandible Radiation was employed by combining roentgen therapy and the implantation of radon seeds A tumor tissue dosage of 6800 gamma roentgens was delivered

FIG 11 14 (*Right*)—The same patient shown in Fig 11 13 eight years after radiation therapy

of a moulage which has the same conformity as the bony cavity Also when a portion of the soft palate is lost it is possible to extend the denture posteriorly and this device partially fills the opening between the oral cavity and nasopharynx.

SOFT PALATE. Early superficial lesions less than 1 0 cm in diameter are readily treated by simple excision and primary closure Unfortunately 90 per cent of squamous carcinomas of the soft palate are more advanced and in these cases one of the radiation techniques is indicated

Roentgen irradiation through a peroral cone is highly satisfactory for growths 3 0 cm or less in diameter Relatively farther advanced lesions receive roentgen therapy through lateral ports and a substantial (although not a carcinocidal) tissue dosage may be delivered by this technique.

Combined roentgen and interstitial irradiation is the most satisfactory method of controlling carcinoma of the soft palate According to the adaptabilities of the peroral cone, approximately one half of the radiation may be delivered in this manner and the remainder of the required carcinocidal dosage may be supplemented by the implantation of radon

seeds A minimum of 6000 tissue roentgens may be delivered by this combined program without great risk of causing a perforation of the soft palate

Treatment of Cervical Metastases Treatment is the same as for metastases from other forms of intraoral carcinoma. If there is palpable involvement of the cervical lymph nodes a radical neck dissection is performed on completion of treatment for the primary growth Varying reports indicate that from 25 to 45 per cent of patients demonstrate cervical metastases on admission

If no metastases are clinically demonstrable when the patient is first examined, immediate treatment to the neck is not given After the primary lesion has healed, the patient is kept under periodic observation Development of cervical metastases subsequent to the treatment of the primary lesion is reported in from 10 to 15 per cent of cases

Prognosis

Growths on the hard palate show a five-year survival rate of approximately 35 per cent, as compared with 15 to 20 per cent for those on the soft palate

DIFFERENTIAL DIAGNOSIS

Precancerous Lesions

Carcinoma of the palate arises in patients in the older age group in whom the mucous membranes are atrophic, more easily irritated, and in general less able to withstand even normal irritation Precancerous



FIG II 15—Advanced irregular and nodular localized plaque of leukoplakia of a precancerous type



FIG 11 16 (*Upper*)—Advanced localized precancerous leukoplakia.

FIG 11 17 (*Lower*)—Advanced generalized leukoplakia associated with an abnormal hyperplastic mucous membrane

states or other changes are grossly evident in at least one-half of these patients

Leukoplakia Thirty-five per cent of patients with carcinoma of the palate show leukoplakia on the mucous membranes It is much more commonly observed on the hard palate than on the soft palate, but its presence on either palate suggests a definitely altered or abnormal mucous membrane

Senile Mucous Membranes The majority of patients with carcinoma of the palate present signs of atrophy, erythematous coloration irritative



FIG 11 18—Advanced precancerous leukoplakia, frequently seen in heavy smokers

erosions and atrophic glossitis. These changes are not clearly understood, but they have to do directly with the aging process, which in some degree at least, involves changes in protein assimilation and metabolism

Inflammatory Lesions

Simple Inflammatory Ulcers As frequent on the palate as on other oral surfaces, such ulcers may arise from denture irritation or may be nonspecific granulomas The greatest number appear in the midline of the hard palate among heavy smokers.

Specific Ulcers Tuberculosis or syphilis specific lesions are extremely rare, and their coexistence with carcinoma on these surfaces is even more rare Both diseases present ulceration which cannot be distinguished clinically from carcinoma hence, biopsy is the only method of differential diagnosis

Fatal Granuloma of the Midline Tissue of the Face A rare, necrotizing lesion, this granuloma as its name implies, involves, at some time usually early, the midline structures of the palate Destruction of soft tissue as well as of bone with extension into the maxillary and nasal



FIG 11 19—Nonspecific chronic ulcer simulating the classical crateriform appearance of carcinoma



FIG 11 20—A tertiary syphilitic lesion (gumma) which has caused a defect in the soft palate



FIG. 11-21 (*Upper*)—Lethal granuloma of the midline tissues of the face

FIG. 11-22 (*Lower*)—A pseudopapilloma





FIG. 11 23 (*Upper*)—Pseudopapilloma of traumatic origin from a partial denture

FIG. 11 24 (*Lower*)—The same patient as shown in Fig 11 23 with the pseudopapilloma on a broad base and a hyperplastic mucous membrane

sinuses, is inevitable The diagnosis cannot be made upon biopsy alone, for the structural characteristics are nonspecific and consist of variable numbers of inflammatory cells and necrotic tissue The correlation of such findings with the clinical history is necessary in order to make a diagnosis The course of this disease usually takes months, with death resulting from sepsis, cachexia, and occasionally meningitis All forms of treatment have been unsuccessful, although certain palliation has been achieved recently with cortisone and x-ray therapy

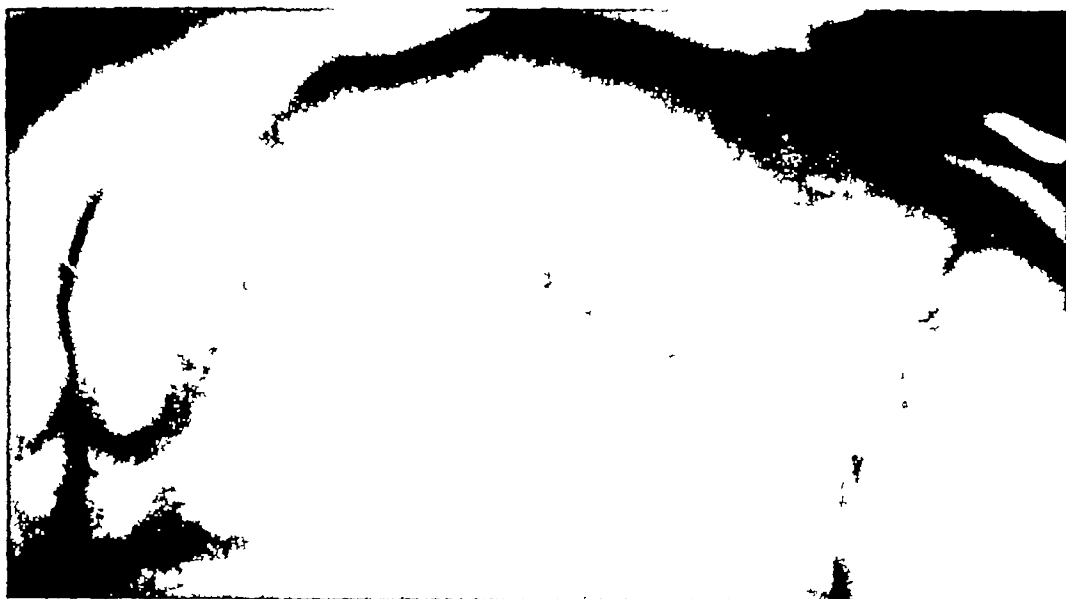


FIG 11 25—Fibroepithelial hyperplasia of traumatic origin from irritation

Benign and Malignant Tumors

Papillomas of the Hard and Soft Palate These lesions are similar to those on the other oral surfaces Singly, they may be on any part of the mucosa but are most frequently found in the central zone Their appearance is not unlike that of a mucosal wart A multiple papillomatouslike lesion is often noted in the central zone and may cover an area of 1 0 to 3 0 cm This pseudopapillomatosis is an inflammatory lesion commonly attributed to excess vacuum relief under a full upper denture It has not been observed to precede carcinoma The treatment is discontinuance of use of the denture If inflammation does not subside promptly, a cautery-excision of the area is in order

Minor Salivary Gland Tumors These tumors occur in the mucous glands of the mucosa of the lip and intraoral surfaces and are not common, but they may precisely duplicate most of the tumors of the major salivary glands (parotid, submaxillary, and sublingual) Gross characteristics of these infrequent lesions cannot be described as readily as for



FIG 11 26 (*Upper*)—A mucosal wart on the uvula.
FIG 11 27 (*Lower*)—Diffuse interstitial hemangioma

their counterpart in the major salivary glands However, histopathologic comparison between major and minor salivary gland tumors is readily made The palate is the most frequent site of these tumors A classification of the more common minor salivary gland tumors is given below

I Mixed tumors
  A Benign
  B Malignant



FIG 11 28—Cavernous hemangioma involving the hard and soft palate with destruction of the palatal processes of the maxilla and palatine bones, and involvement of the left antrum

II Carcinoma
  A Adenocarcinoma
    1 Adenoid cystic
    2 Solid basal cell
    3 Mucous cell
    4 Anaplastic
  B Mucoepidermoid
    1 Low-grade
    2 High-grade
  C Epidermoid

MIXED TUMORS These tumors have been so designated because of their complex histologic structure (mucoid, chondroid, and epithelial) They are among the debatable tumors because of the controversy regarding





FIG 11 29 (*Upper*)—Nasopalatine cyst.
FIG 11 30 (*Lower*)—Benign mixed tumor of salivary gland origin.

their histogenesis Should their complex structure be considered to support the theory of origin from both connective and epithelial tissues, or should such histologic characteristics be considered the result of metaplasia of the epithelial components? In this discussion it is assumed that the mixed tumors are complex only in the descriptive and not in the derivative sense All components can be explained on the basis of the changes in epithelial cells and in their secretions



FIG. 11 31—Benign mixed tumor of minor salivary gland origin presenting as a dome-shaped swelling On palpation it is found to be spherical and movable under the mucous membrane

1 *Benign mixed tumors* are the commonest of the mucosal appendage tumors They are sharply circumscribed but are not truly encapsulated, and the capsular surface is usually smooth Surfaces made by cutting are frequently dotted with small cystic spaces which often exude mucus Opaque-white areas are present, some of which are ordinarily replaced by gelatinous softening and glistening cartilage

Microscopically, the majority of these tumors present complex patterns of epithelial elements in the form of cell strands, ducts or diffuse masses which surround or fade into mucoid, cartilage, or connective tissue Squamous cells are frequently present, and intercellular bridges,

pearl formation and keratohyaline granules may be demonstrated. The duct structure may have a single layer of epithelium, but in many cases there are several layers of cells.

2. *Malignant mixed tumors* are rare. The decision as to whether or not a given mixed tumor is capable of metastasis is at best a difficult one to make. Grossly, the malignant tumors have a more bosselated surface, and although circumscribed, there are areas where the pseudocapsule appears infiltrated and the cystic changes noted in the benign form tend to be larger. Areas of friable granular tissue replace the more glistening, firm benign mixed tumor component.

   Microscopically, superimposed upon the identifiable mixed tumor structure there are malignant cellular areas usually composed of either an adenocarcinoma or an epidermoid carcinoma, although some areas may have spindle and giant-cell components.

CARCINOMA

1. *Adenocarcinomas* have a wide structural range. The adenoid cystic carcinoma is an infrequent tumor on the intraoral surfaces. Other adenocarcinomas are designated as solid basal-cell, mucous-cell and acinic-cell carcinomas.

   a. *Adenoid cystic carcinomas* are known by various names, the most common one being *cylindroma*. They are quite well circumscribed, firm, and on sectioning are seen to be homogeneous gray to yellowish white. Externally they may resemble the mixed tumors, but when sectioned it is seen that they lack the cystification and mucoid content.

      Microscopically the range of structural variations may be little or marked, and numerous sections may be necessary to differentiate from a mixed tumor. The characteristic cell is a dark staining small cell with little cytoplasm grouped together either as solid cords or in an adenoid pattern. The round spaces of the latter often contain mucus. Surrounding the solid cords or adenoid structures and often haphazardly distributed throughout the microscopic field is a dense hyaline or mucous hyaline stroma. In tissue where nerves have been included, perineural lymphatic involvement is commonly noted.

   b. *Solid basal-cell carcinomas* are another unusual structural type in which the tumor is composed of medium sized cells with hyperchromatic nuclei enclosed in delicate trabeculae. Mitoses are common.

   c. *Mucous-cell adenocarcinomas* are structurally similar to the adenocarcinomas seen in the gastrointestinal tract and are for the most part low grade.



FIG 11 32 (*Left*)—A large mucoepidermoid carcinoma involving the entire right soft palate, which proved to be encapsulated at the time of surgery

FIG 11 33 (*Right*)—Adenocarcinoma of minor salivary gland origin, presenting as an ulcerated tumor mass with invasion of the hard palate





FIG 11 34 (*Left*)—Bulky nonulcerated adenocarcinoma of minor salivary gland origin with invasion of the entire hard palate

FIG 11 35 (*Right*)—Malignant melanoma involving the uvula and invasion of the soft palate

d *Anaplastic adenocarcinomas* resemble the so-called transitional-cell carcinomas The tumors have broad bands of connective tissue separating islands of small cells with noticeable cell borders, and a nucleus not unlike that of a reticulum cell

2 *Mucoepidermoid tumors*, a form of salivary gland tumor, arise from the larger and intermediate-sized ducts and are characteristically composed of cells with epidermoid appearance and mucous- and non-mucous-secreting cells They are malignant tumors behaving as low-grade or as high-grade carcinomas The gross characteristics depend on whether they are of low- or high-grade malignant character

a The *low-grade tumors* tend to be circumscribed but not encapsulated are generally firm and when sectioned are seen to be partially cystic The cystic spaces contain a mucoid material the solid portions being gray white

b The *high grade tumors* are not circumscribed are multilobulated firm, and when sectioned tend to be homogeneous gray white with few cysts and without the mucoid characteristic of the low grade tumor

Microscopically the low grade tumors reveal the presence of multiple-cell types (mucus secreting cells columnar cells epidermoid cells and intermediate cells) and these cells are more distinctive than those of the higher grade tumors Another characteristic of this low malignant level is the accumulation of large pools of mucus. The more this feature is present the less malignant the tumor The basal cells can be seen to proliferate and because they are pluripotent they differentiate into an intermediate cell or directly into mucous or columnar cells (the latter chiefly at the luminal margin) Basal and intermediate cells appear capable of epidermoid metaplasia and in some mucoepidermoid tumors this metaplastic type of cell predominates The epidermoid component resembles squamous cells without intercellular bridges the basal cells are similar to those of the skin tumors of that name and the intermediate cell is larger than the basal cell and smaller than the epidermoid cell In the more malignant tumors mucous cells are far fewer epidermoid and intermediate cells being the predominant components

Other Malignant Tumors

Other malignant tumors include rhabdomyosarcoma (see Chap 7) fibrosarcoma (see Chap 3) and melanoma (see Chap 6) The diagnosis of these malignant tumors depends on the biopsy

READING REFERENCES

FOOTE, F W JR., and E. L FRAZELL "Tumors of the major salivary glands," *Cancer* 6:1065–1133 (1953)

MARTIN H. E "Tumors of the palate (benign and malignant)" *Arch Surg* 44:599–635 (1942)

MOORE, P M E. E. BEARD T W THOBURN and H L. WILLIAMS "Idiopathic (lethal) granuloma in midline facial tissues treated with cortisone report of a case, *Laryngoscope* 61:320–331 (1951)

SHARP G S "Radium and x ray in the treatment of cancer of the head and neck," *Arch Phys Therapy* 21:549–557 (1940)

SMITH, A G, T R BROADBENT, and A A ZAVALETA "Tumors of the oral mucous glands," *Cancer* 7.224–233 (1954)
THOMA, K H "Papillomatosis of the palate," *Oral Surg Oral Med Oral Pathol* 5.214 (1952)
YATES, P O, and G E PAGET "A mixed tumor of the salivary gland showing bone formation with a histochemical study of the tumor mucoids," *J Pathol Bacteriol* 64 881–888 (1952)

CHAPTER 12

Lesions of the Nasal Cavities and Paranasal Sinuses

The nasal cavities and the paranasal sinuses are discussed together because of their proximity to one another The benign and malignant neoplasms of all these air-containing spaces are similar and it is often difficult to determine in which of the several different sinuses the primary growth may have originated The presenting complaints of neoplastic disease in these regions are frequently indistinguishable from those of inflammatory origin

APPLIED ANATOMY

A thorough knowledge of the positional relations the intercommunicating passages and the innervation of these pneumatic cavities is necessary to localize the origin and extent of the disease

The nasal passages are interposed between the cranial cavity above and the oral cavity below and between the orbits and maxillary sinuses The cavities are separated by the nasal septum, a cartilaginous and bony structure consisting of a vertical plate of the ethmoid and vomer bones The roof of the spaces is made up of the cribriform plate where direct extension of both neoplastic and infectious processes into the cranium is possible. The floor is a smooth mucosal covering over the bones of the palate and is perforated by the incisal or nasal palatine canal The lateral wall of this cavity is occupied by the nasal conchae through which direct communication exists between the maxillary ethmoid, and sphenoidal sinuses The epithelium lining the nasal cavities is of two types stratified squamous, and ciliated pseudostratified columnar (Schneiderian) The former lines the vestibule and anterior tips of the middle and lower turbinates The Schneiderian epithelium is divided into the respiratory and olfactory and the margins between have no exact boundaries Under pathologic conditions alteration by metaplasia may be prominent and further change the distribution of these tissue types In addition the

mucosa is connected to the periosteum by a rather thick submucous layer, in which seromucous glands are embedded Carcinoma and adenocarcinoma arise from these structures

The maxillary sinus, or Highmore's antrum, is the largest of the paranasal sinuses and normally occupies the entire body of the maxilla The sinus may be described as a four-sided pyramid, the base of which is the vertical-lateral nasal wall, while the apex extends into the zygomatic process of the maxilla The floor of the sinus is situated on the base of the alveolar process, where there is a close relationship with the dental roots The roof of the sinus is also the floor of the orbit The only communication with the nasal cavity is through an orifice into the middle meatus of the nose, which may become occluded by inflammation or a tumor

The lining of the sinuses is thinner than the lining of the nasal passages It is a fusion of the periosteum and the mucous membrane and is called the mucoperiosteum The membrane is inelastic is poor in glands and blood vessels and is covered with a ciliated, pseudostratified columnar respiratory epithelium

Neoplasms or infection may invade the narrow canals containing the alveolar nerves in the posterior and anterior wall of the sinus These nerves are in direct contact with the mucoperiosteal lining of the sinus, producing referred dental pain

The frontal sinuses are situated between the inner and outer tables of the frontal bones They are connected with the middle meatus of both fossae by openings from the floors of each sinus and are lined with mucous membrane similar to the lining of the maxillary ethmoid, and sphenoid sinuses The ethmoid cells are situated in the lateral wall of the nasal fossa with multiple orifices of entrance into the posterior-superior nasal passages The ethmoid cells are lined with mucoperiosteum which is continuous with but thinner than, the mucosa of the nasal fossa The sphenoid sinuses are located in the body of the sphenoid bone Their orifices open into the superior meatus of the nose The mucoperiosteum lining these spaces is similar to that of the other sinuses and is continuous with that of the nasal fossa and the nasopharynx

CARCINOMA OF THE NASAL CAVITIES AND PARANASAL SINUSES

Carcinoma of the nasal cavities and the paranasal sinuses has an unusually varied symptomatology and clinical course, because of the intricate and close anatomic relation of the various spaces Since most of the sinuses are essentially closed and the cavities clinically inaccessible,

initial symptoms must be carefully evaluated, for difficulties in diagnosis are many

The index of suspicion of carcinoma must remain high, for procrastination will prevent early recognition of tumors in these areas More definitive diagnostic procedures than roentgenographic studies are a requirement. Biopsy is not always a simple procedure but tissue must be obtained Frequently surgical exposure is necessary

Incidence

Carcinoma of the nasal cavities and paranasal sinuses is relatively rare (0.2 per cent of all the carcinomas of the body) but of sufficient frequency to warrant consideration in a differential diagnosis It occurs predominately in males (3 1) The average age at detection in the male is approximately fifty seven in the female sixty three

Etiology

Causative factors for the development of carcinoma in these areas, so far are not known. Chronic sinusitis polyps, and hyperplasia of the mucous membranes are apparent, but their role in the development of carcinoma is not established.

Histopathology

Carcinomas occurring in these cavities are usually epidermoid (frequently transitional or spindle cell in type) and rarely glandular The lesion is usually of medium or high grade and bulky When it arises in the accessory sinus (usually maxillary) or in the nasal cavity contiguous involvement of adjacent structures is often present at the time of diagnosis The maxillary sinus is most frequently involved and its bony walls are almost always affected the anterior and medial walls most often, the roof and floor next. Other spaces involved, in descending order of frequency are the nasal, then the ethmoid, sphenoid, and frontal sinuses The epidermoid carcinomas are usually of high grade and have little keratinization, lack intracellular bridges and have rather distinct cytoplasmic borders.

There is one characteristic tumor occurring in these structures a transitional-cell carcinoma. It is more frequent in the nasal cavities than in the sinuses but is of course more frequent in the nasopharynx and tonsil. It may be either a plateaulike or a bulky lesion and may grow either speedily or slowly Unlike the more differentiated epidermoid carcinomas, this tumor tends to metastasize to regional lymph nodes and distantly to viscera and bones.

The transitional or spindle-cell variety is more vascular and has



ıc. 12 1 (*Upper*)—Squamous carcinoma arising in the mucous membrane of he septum It is crateriform and partly ulcerated, and it invades cartilage
ıc. 12 2 (*Lower*)—Squamous carcinoma of the right antrum with tumor tis ue presenting in the right naris The tissues of the cheek are invaded, and the ight eye is displaced upward and outward from infiltration through the floor f the orbit

cells that are oval to spindle in shape with relatively little cytoplasm In either type squamous changes with epithelial or keratin pearls may occur The more dedifferentiated these tumors are the more prevalent the mitoses In the vestibule of the nares the carcinoma may be epidermoid or basal-cell the epidermoid variety is of a lower grade than that in the nasal cavity proper but invasion is extensive Basal cell carcino-



FIG 12 3—Squamous carcinoma of the antrum with slight swelling of the left cheek, partial paralysis of the left upper eyelid as well as swelling in this area from obstruction of the nasal lacrimal duct.

mas have the same appearance and behavior as those elsewhere on the skin.

The adenocarcinomas arise from the seromucous glands The adenoidcystic is the most common, but any of the types discussed in Chapter 11 may occur the mixed tumor being the least common

Clinical Characteristics

Carcinoma of the paranasal sinuses usually occurs in an already diseased area, intensifying preexisting symptoms The initial symptoms are invariably soreness, aching or pain usually followed by swelling of the cheeks and palate loosening of the teeth development of traumatic

occlusions and dental pain The possibility of malignancy should be considered and investigated immediately on the appearance of any of these symptoms

Ulcerous lesions on the palatal surfaces or in the buccogingival groove or the unaccounted-for loosening or hypereruption of teeth may be the result of cancer originating in the maxillary antra or nasal cavities



FIG 12 4—Same patient shown in Fig 12 3 Invasion and destruction of the medial wall of the antrum and floor of the orbit are seen.

In the Nasal Cavities Carcinoma here often produces a blood-streaked nasal discharge obstruction, and later frank bleeding Frequently the actual tumor mass presents at the anterior nares or into the posterior choanae

In the Maxillary Antra The disease in this area may produce tenderness and aching in the upper jaw, with pulpal or periosteal pain of one or more teeth A blood-streaked nasal discharge is an early symptom As the growth fills the cavity, it exerts pressure and fungates into the nose, the dental alveoli, through the palate, or through other walls Primary cancer arising in the upper part of the antrum may invade the floor

of the orbit, elevating the eyeball and may even cause unilateral exophthalmos Ptosis or exophthalmos is evidence of violation of the superior wall (orbital plate)

In the Ethmoid Cells Carcinoma in this location will cause deep-seated aching pain behind the eye bloody nasal discharge and an early erosion



FIG 12 5—Squamous carcinoma filling the left antrum with uniform density destruction of the medial wall and floor of the orbit.

or invasion of the nasal wall of the orbit Ptosis displacement of the eye laterally edema of the eyelids conjunctivitis and lacrimation are subsequent symptoms

In the Sphenoid Sinuses Carcinoma in these sinuses produces a similar deep aching pain behind the eyes and a bloody nasal discharge Invasion of the bony walls occurs early and tumor tissue is frequently present in the posterior orbit, causing exophthalmos with strabismus and unilateral trismus and later swelling in the temporal fossa

In the Frontal Sinuses Carcinoma in these spaces is extremely rare Pain in the frontal region is frequently the only subjective symptom



FIG. 12 6—Squamous carcinoma with destruction of all walls of the right antrum, invasion of the cheek the nares and orbit

In the paranasal sinuses the uninterrupted course of the disease may ultimately cause a destruction of the entire maxilla, an exophthalmos and extensive infiltration of the tissues of the cheek and of the pterygomaxillary fossa

Metastases to the Cervical Lymph Nodes or Lungs Except when the primary lesion is the transitional type (Schneiderian) of carcinoma, such metastases are rare

Diagnosis

Definite histologic diagnosis is important in all instances where chronic sinus disease is progressing and does not respond to antibiotic therapy irrigations, and drainage. A careful description of the onset of symptoms is helpful since it may disclose the primary site of origin However this



FIG 12 7—A transitional-cell carcinoma filling the right antrum and an incidental osteoma of the left frontal sinus.

is frequently impossible to determine because of the nearness of these cavities to each other

1 Roentgenograms are not of diagnostic value in differentiation between infection and neoplasm in the early stages of the disease but stereoscopic films in the more advanced growths define clearly the amount of bone destruction and the approximate boundaries of the tumor
2. A bloody nasal discharge is a common sign of carcinoma in the nasal cavities and sinuses A smear of the discharge or the washings is frequently helpful but a negative report is inconclusive.

3 Incisional biopsy is required in cases of carcinoma of the frontal or sphenoid sinuses
4 Forceps biopsy is readily performed for all ulcerated growths in the nares



FIG 12 8—Sweat-gland carcinoma of the right cheek with direct invasion of the maxilla into the antrum and orbit

5 The aspiration, or punch, biopsy may be very satisfactory in the maxillary antra Frequently a loosened tooth from carcinoma of the antrum may be extracted and tumor tissue obtained from its apices or from within the alveolus

Treatment

Carcinoma of the sinuses is invariably accompanied by invasion of bone or cartilage The surgical treatment is a partial or total resection of the maxilla and adjacent structures as required Carcinoma in the

olfactory areas of the nasal cavities is usually of a radiosensitive transitional-cell type and may be treated by radiation Decision on the program of treatment should not be made until complete appraisal is given to the symptomatology roentgenographic studies, and biopsy

Biopsy and Drainage These measures are usually accomplished at the same time and the latter immediately relieves symptoms of increased pressure within the sinuses Conservative surgery or dental extraction together with antibiotic therapy is quite satisfactory for biopsy of all but the frontal and sphenoid sinuses



FIG 12 9—Adenoid cystic carcinoma arising in the antrum

Treatment of the Primary Growth In most instances treatment is by surgery

1 Early growths in the maxillary antra and lower half of the nasal cavities may be removed by partial resection of the maxilla from the level of the infraorbital fossa downward, including the required amount of the palatal process of the maxilla and the palatine bone. This moderately conservative surgery may be accomplished through an oral approach. Complications are rare and special dentures complete a satisfactory and functional result.
2. More advanced growths and those with evident invasion of bone in the upper part of the antrum and primary tumors of the ethmoid and



FIG 12 10—Adenoid cystic carcinoma filling the left antrum with expansion and erosion of the medial wall and minimal destruction of the zygoma

sphenoid sinuses require a complete resection of the entire maxilla including the contents of the orbit The resection may be accomplished in block fashion by dividing the bone along the boundaries of the maxilla on all sides Carcinoma of the ethmoid cells deserves additional attention in this area, and the cribriform plate and possibly a portion of the base of the skull may also be included For growths



Fig 12 11—Carcinoma of the antrum with invasion of the orbit nine years after radical surgery

primary in the sphenoid sinuses and others infiltrating the pterygomaxillary fossa the resection may require the removal of the contents of both these areas together with a portion of the body of the sphenoid bone This procedure requires a complete exposure with a reflection of the cheek laterally The cheek contour may be maintained by adapting a mold made from dental modeling compound. This may be applied to the cavity at the time of surgery and serves as an excellent packing Dentures may be used to separate the oral and nasal cavities and thus restore a degree of function

3. Carcinomas in the olfactory areas of the nasal cavities are customarily treated by radiation procedures X ray therapy in conjunction with radium packs may be given in carcinocidal doses. Efforts should be made to deliver 6000 tumor tissue roentgens to carcinomas in this area

Cervical Lymph Node Metastases Such metastases are uncommon but when present, are often associated with the transitional-cell carcinomas Their treatment requires radical block dissection if and when the primary lesions are controlled. More distant metastases from this form of carcinoma may occur

Palliative Therapy Adequate drainage and roentgen therapy may provide symptomatic relief quite satisfactorily for months Pain may be relieved partially or completely by nerve block injections with alcohol

Prognosis

Although there is a significant improvement in the five-year survival rate since the advent of radical surgery, the prognosis is poor Unlike



FIG 12 12–Same patient as in Fig 12 11, with upper denture mold in place to provide watertight closure

carcinoma of the oral surfaces, carcinoma of the paranasal sinuses is relatively hidden and is symptomless in its early stage, so that medical advice is not obtained until the disease is well advanced It is estimated that approximately 15 per cent of patients are free of disease for a five-year period after surgery

DIFFERENTIAL DIAGNOSIS

Precancerous Lesions

The situation with regard to precancerous lesions is unlike that in the oral cavities. Few lesions are recognized in the paranasal sinuses and nasal cavities which have a direct relationship with the development of carcinoma Infrequently carcinoma may develop in a preexisting lesion

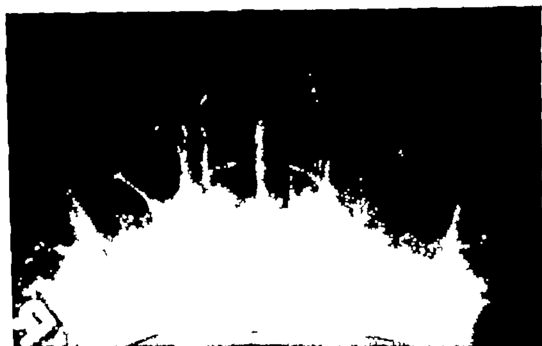


FIG. 12 13—Mucocele of the left antrum

Schneiderian Papilloma (Epithelial Papilloma) This is a rare tumor of the nasal cavities accessory sinuses and nasopharynx. It differs from the ordinary polyps of these regions by being nontranslucent and by arising usually from a broad base The surface epithelium is of the transitional-cell type The epithelium at times has numerous vacuolated cells and marked acanthosis appearing not unlike that seen in *condyloma accuminata* These are histologically benign tumors but some have a tendency to recur grow into and fill the paranasal sinuses as well as the nasal cavity They ulcerate, bleed easily and become infected. Those which behave in this manner are not histologically different from those that do not recur after removal In spite of the long history of residual tumor and the fact that the epithelium may become more aggressive in appearance few of these tumors develop into carcinoma.

Inflammatory Lesions

Chronic sinusitis is a frequent precursor to the common antracl polyps The relationship of such inflammation to the occurrence c cinoma is not known

Polyp The common nasal and antrachoanal polyp is due to c irritation and periodic allergic reactions Polyps are characteris edematous, pale, translucent, yellow-white structures exhibiting able amounts of surface erosion or ulceration Microscopically, the tural characteristics vary from marked edema, sparse stroma, fe flammatory cells, and a respiratory epithelial covering to marked fi numerous seromucous glands, many plasma and eosinophil cells replacement in part of the respiratory epithelium by squamous e lium Erosion and ulceration of the surface are common Can degeneration is rare, but all nontranslucent polyps should be sub for microscopic examination, in order to make sure that they are innocuous type Recurrence after removal is the rule

Benign and Malignant Tumors

The benign tumors of the nasal and paranasal cavities are uncor They can be divided into those neoplasms arising from nerve ele vascular structures, supporting connective tissue, and epithelium

Hemangiomas of the nasal structure are more common than th the accessory sinuses They are structurally the same as those disc in Chapter 3

Nerve Tumors Growths of this type are uncommon The neurofibr neurilemmomas, and ganglioneuromas differ in no way from thos elsewhere in the body They are structurally the same as those disc in Chapter 3 There is one rare tumor, the esthesioneuroblas which is said to arise from the olfactory placode It is structurally a r blastoma, but its biological behavior is rather unpredictable and behave as a benign tumor An extracranial meningioma may or occasions be present in the nasal cavity or sinuses

Intranasal Neurogenic Tumors Such lesions are rare They c divided into two categories, tumors and developmental errors tumors are derived from nerve tissue or its covering and include r fibroma, neurilemmoma, malignant schwannoma, neuroblastoma, r cytoma, and neuroepithelioma The developmental errors include n gocele, encephalocele, and nasal glioma These latter present th a defect in the base of the skull In the nasal glioma the orifice c leaving the brain tissue isolated in the nasal cavity

Neuroblastoma, Neurocytoma, and Neuroepithelioma The si origin of these tumors is debatable, but they are presumed to arise

the olfactory area They comprise approximately 3 per cent of intranasal tumors excluding the common nasal polyps The neuroblastoma and neuroepithelioma are considered to be highly malignant, while the neurocytoma is believed to be benign and makes up 60 per cent of this group

Grossly the malignant tumors are of soft, friable consistency and vary from gray to yellow in color The tissue of the benign tumors may be



FIG 12 14—Boeck s sarcoid of the nares with destruction of alveolar and cortical bone and the medial walls of the antra

similar to that of a nasal polyp but is usually more opaque and vascular Microscopically the neurocytoma is made up of uniform mature cells with numerous fibrous septa dividing the tumor into compartments The malignant tumors are differentiated from the benign by the presence of true rosets (neuroepithelioma) pseudorosets (neuroblastoma) as well as by the variations in cell maturity Neurofibrils are present in all

The onset of neurocytoma is insidious, with or without a history of sinusitis obstruction of nares, epistaxis or nasal discharge Examination discloses a polypoid mass which is more firm, dark, and red than the usual nasal polyp Such masses bleed easily when touched. Some present as an edematous tumefaction on the lateral nasal wall The malignant types have a similar history and the tumors may be more friable The diagnosis can be made only by microscopic examination, although a



FIG 12 15—Hemangioma of the naris arising on the inferior turbinate bone

FIG. 12 16—Osteoma partially filling the left naris and antrum.

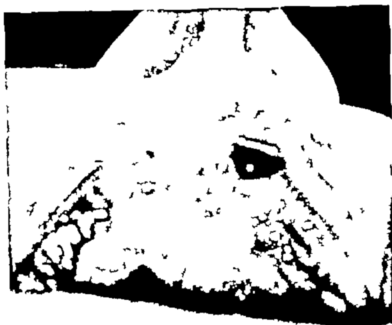




FIG 12 17 (*Upper*)—Reticulum-cell sarcoma with ulceration of alveolar ridge and palate

FIG 12 18 (*Lower*)—Same patient as in Fig. 12 17 showing the destruction of the alveolar ridge and palate



FIG 12 19—Same patient as in Figs 12 17 and 12 18, with destruction of the walls of the antrum, obliteration of the cavity, and partial occlusion of the nares.



FIG 12 20 (*Left*)—Lymphocytic leukemia of the antrum with a smooth dome-shaped tumor mass on the hard palate and alveolar ridge

FIG 12 21 (*Right*)—Same patient as in Fig 12 20 The antrum is filled with tumor tissue the walls, as well as the alveolar ridge and palate are partly destroyed.



FIG 12 22 (*Left*)—Malignant melanoma of the nares extending through the palate to ulcerate into the oral cavity

FIG 12 23 (*Right*)—Metastatic carcinoma from the pancreas to the right frontal sinus

lesion differing from a nasal polyp should be suspected because of its unilaterality

The benign tumors are treated surgically, and the prognosis is good The treatment of the malignant type is by surgical removal and radiation therapy, but the prognosis is uniformly bad

Fibromas. These growths are exceedingly rare The angiofibroma, which arises in the vault of the nasopharynx and secondarily occupies the nasal chambers, is a benign tumor characteristically seen in adolescent males

Seromucous Gland Tumors These growths are rare but do infrequently occur in the nasal cavities

Other Malignant Tumors

The malignant tumors which occasionally occur in these regions and may be confused with the carcinomas are the malignant lymphomas, fibrosarcoma, rhabdomyosarcoma, angiosarcoma, and melanoma

READING REFERENCES

BLADY J V "Treatment of diseases of the naso-accessory sinuses," *Clinical Therapeutic Radiology* U V Portmann, editor The Williams & Wilkins Company Baltimore 1950 pp 80–92.

CONLEY J J "Free skin grafting in sinus oral, and pharyngeal areas in radical surgery of the head and neck," *Cancer* 7:444–454 (1954)

NEW G B., and K D DEVINE "Neurogenic tumors of nose and throat" *Arch Otolaryngol* 46:163–179 (1947)

DEL REGATO J A "Cancer of the nasopharynx," *Clinical Therapeutic Radiology* U V Portmann editor The Williams & Wilkins Company Baltimore, 1950 pp 93–105

SCHALL, L A and M LINEBACK "Primary intranasal neuroblastoma," *Ann Otol Rhinol & Laryngol* 60:221–229 (1951)

SCHOOLMAN J G and H W ANDERSON "Malignant melanoma of the nose and sinuses" *Ann Otol Rhinol & Laryngol* 59:124–141 (1950)

SHARP G S "Carcinoma of the maxillary antrum technic of treatment," *Radiology* 17:984–1013 (1931)

SIMMONS, M W., and J W ARIEL "Carcinoma of the nasopharynx," *Surg Gynecol Obstet* 88:763–775 (1949)

WATSON W L. "Cancer of the paranasal sinuses *Laryngoscope* 52:22–42 (1942)

Introduction to Part Three

By definition tumors of bone include only neoplasms derived from the cells of the periosteum the bone and the bone marrow—exclusive of the leukemias Part Three has been broadened in scope to include not only all tumors derived from bone, but also those from the epithelial reticuloendothelial blood lymph, and nerve tissues as well as tumors metastatic to the jaws Therefore all tumors arising, primarily or secondarily within bone are discussed.

Skeletal and odontic lesions have been systematized according to numerous criteria, but no single classification has found universal acceptance Tumors of the jaw bones differ little from their counterparts elsewhere in the body The jaws contain teeth, however and because of this anatomical variation it has been the custom to relate the origin of many odontic (related to teeth) lesions to irregularities in the embryogenesis of teeth. This has resulted in a classification of odontic lesions which is complex and misleading. The classification used in this text is based primarily upon concepts of pathology applicable to the entire skeleton with allowance for the special pathology of the lesions occurring in close proximity to the teeth

The view that the evolution of a neoplastic process can be understood merely by retracing the steps of embryologic development has long been discarded by pathologists Increasing attention is being paid to the cell and to its ability to acquire biologic characteristics other than those implied by its lineage While much of the descriptive pathology regarding the odontic lesions refers to the germ layers, the specificity of even these bulwarks to the embryologist is no longer tenable and is of less significance to the pathologist. The environment and stimuli to which cells are exposed have greater influence upon the direction of any biological digression than does their origin

The cell is a complexity of molecular structures with a hierarchical organization centering around the genetic apparatus Physiologic or pathologic alterations within a cell are believed to occur on this molecular level In histophysiology the cells are regarded as having irrevocable assignments. However in histopathology the intermutability of various mesenchymal cells is now commonly recognized Cells once thought to be distinct entities i.e. fibroblast, osteoblast, osteoclast, odontoblast etc., are now known to be capable of varying and reversible behavior in response to abnormal histogenetic stimuli. Likewise intermutable be

havior of ectodermal cells is also recognized in certain instances The cells can assume morphologic and physiologic alterations without loss of type specificity When such cells are grown in tissue culture they revert to their prototype Therefore, from the microscopic morphology of the tumors discussed in this section, the identification of the cell origin is difficult However, for all practical purposes the cellular component is classified according to what it is doing and the company it is keeping

PART THREE

Neoplasms Benign and Malignant of the Jaws

parts of the same tumor have a characteristic microscopic structure The cytologic characteristics of the peripheral basal cells in the ameloblastomas are supposed to show a degree of differentiation comparable to that of the superficial columnar cells of the dental lamina or the internal dental epithelial cells of the enamel organ There is no true stellate reticulum nor stratum intermedium The precursor cell according to this view, is a remnant either of the dental lamina or of the inner enamel epithelium These histologic appearances are due to greater degrees of maturation of cells displaying the morphologic features of unspecialized basal cells These therefore, are epithelial tumors with areas which differentiate in the direction of odontic tissues but never fully obtain this degree of specialization It is not implied that these tumors cannot and do not arise from odontic residues, but simply that valid proof for such an origin has not as of now been adequately documented in the literature

The Basal-cell (Nonodontogenic) Theory of Origin Tumors with a histologic characteristic of an ameloblastoma as seen in the jaws have been traced to the gingival mucosa to follicular cysts, and the pituitary region

In mice the spontaneous tumors arising from the outer enamel layer are squamous in type, and some of these tumors are carcinomatous Cellular epithelial rests are noted in approximately 5 per cent of these animals, and none of this debris is noted to proliferate or take part in any way in the formation of neoplasms

When tooth germs are transplanted into the anterior of the eye the epithelial remnants lose their tall columnar structure and form clusters or cords of epithelial cells, epithelial pearls, keratinized material and occasionally cysts but often they form large islands of basal cells with squamous centers Ameloblastomas are not produced

The development of the teeth in different species is fundamentally the same The stratum intermedium is thought to act as an organizer on the inner enamel cells and this action results in progressive cytologic changes These cells are designated as preameloblasts, and according to the epithelial-remnant theory of origin they give rise to the ameloblastoma However if this viewpoint were correct, a true stellate reticulum and a stratum intermedium should be observed in some of the ameloblastomas Furthermore if these sequential events are necessary for the differentiation of the preameloblasts then odontoblasts and dentin should also be present It is quite well accepted that the ameloblastoma does not form enamel and that therefore the cells are not ameloblasts In addition histologically similar tumors are found in the long bones particularly the tibia The tissue of origin of these tumors is probably synovium

Histopathology

Gross Appearance Grossly these tumors vary in size, consistency and appearance They may be solid or cystic they may expand the jaw bones thin the cortex, and ultimately invade soft tissue. They may however be present as soft tissue mass in the gingiva with only slight bone invasion and expansion. Few early central ameloblastomas of the jaw have been well documented.

Microscopic Appearance The structure of an ameloblastoma of the jaw varies microscopically within wide limits and is related to the degree of differentiation and to the reaction of the host, the latter accounting for many of the gradations of histologic structure. There has been a notable lack of appreciation for this point, resulting in too much attention being focused on the minutia of cellular detail and pattern The diagnosis depends on the clinical roentgenographic, and pathologic findings The peripheral cells the most important cytologic features range from cuboidal to tall columnar The pseudostellate reticular appearance which results from intercellular edema and compression of the cells is often present but is not necessary for a diagnosis There may be many macro- and microcysts The stroma is adult connective tissue and does not resemble that seen in odontic hamartomas It may undergo in addition to cystification, hyalinization and calcification. In addition, numerous other histologic alterations secondary to inadequate therapy may be present. In multiple histologic preparations from a single tumor a varying structure is usually present and nullifies in the histologic sense many of the morphologic subdivisions.

In approximately one third of these lesions the epithelium is seen to extend downward from the overlying gingiva, while approximately a similar percentage are seen to arise from follicular cysts The biological behavior of a given tumor cannot as a rule be correlated with its histologic structure The different microscopic patterns whether comprising large or small areas of a particular tumor all have a predilection for invasion of bone and soft tissues The tumor slowly but surely creeps along the bone vascular spaces and by pressure resorption gradually destroys the cortical bone Variable amounts of reactive fibrosis are present, giving the appearance of pseudoencapsulation. In the overwhelming majority of patients with these tumors unless they are adequately treated the slow but sure creeping destruction of adjacent bone and soft tissue finally leads to death Variance of this pathology is infrequently observed Carcinomatous changes may be present in an early phase of the life history of the tumor or such changes may be associated with the activation due to incomplete surgical intervention Such transformation is usually into squamous carcinoma.



FIG. 13·1 (*Upper*)—Ameloblastoma with extensive involvement of the angle of the mandible ulceration and infiltration into the tissues of the cheek and base of the tongue

FIG. 13·2 (*Lower left*)—Ameloblastoma, with destruction and expansion of alveolar bone and invasion of the palate and floor of the antrum.

FIG. 13·3 (*Lower right*)—Ameloblastoma, with extensive invasion of the entire maxilla, including the floor of the orbit

Clinical Characteristics

As in other tumors of the jaw the clinical characteristics are not pathognomonic, but subjective complaints or objective signs should arouse suspicion of a condition other than a dental root abscess

Initial Complaint The patient's first complaint is often of a painless swelling of the jaw or occasionally of a toothache although these symptoms may not appear for months or even years after the inception of the



FIG 13 4 (*Left*)—Ameloblastoma, with ulceration around the second molar tooth and expansion of the alveolar ridge

FIG 13 5 (*Right*)—Same patient as in Fig 13 4 demonstrating the destruction of bone and roots of the molar tooth

tumor Symptom free tumors not infrequently are detected in roentgenographic surveys of the teeth. In the maxillary tumors pain occurs much earlier in the course of the disease than in those of the mandible Later the patient may complain of spontaneous loosening of the teeth, alteration of normal occlusion or displacement of dentures. Ulceration may occur following extraction, or it may appear spontaneously

Examination As a rule examination reveals a bony swelling intra orally and/or externally with malalignment or loosening of adjacent teeth, and less frequently ulceration. In time the alveolus or even the entire jaw is expanded and the cortical bone eroded to eggshell thinness. Local pressure may cause crepitus or fluctuation. Extraosseous and soft tissue invasion may be demonstrated in approximately 75 per cent of both the peripheral and central types. This is particularly true follow

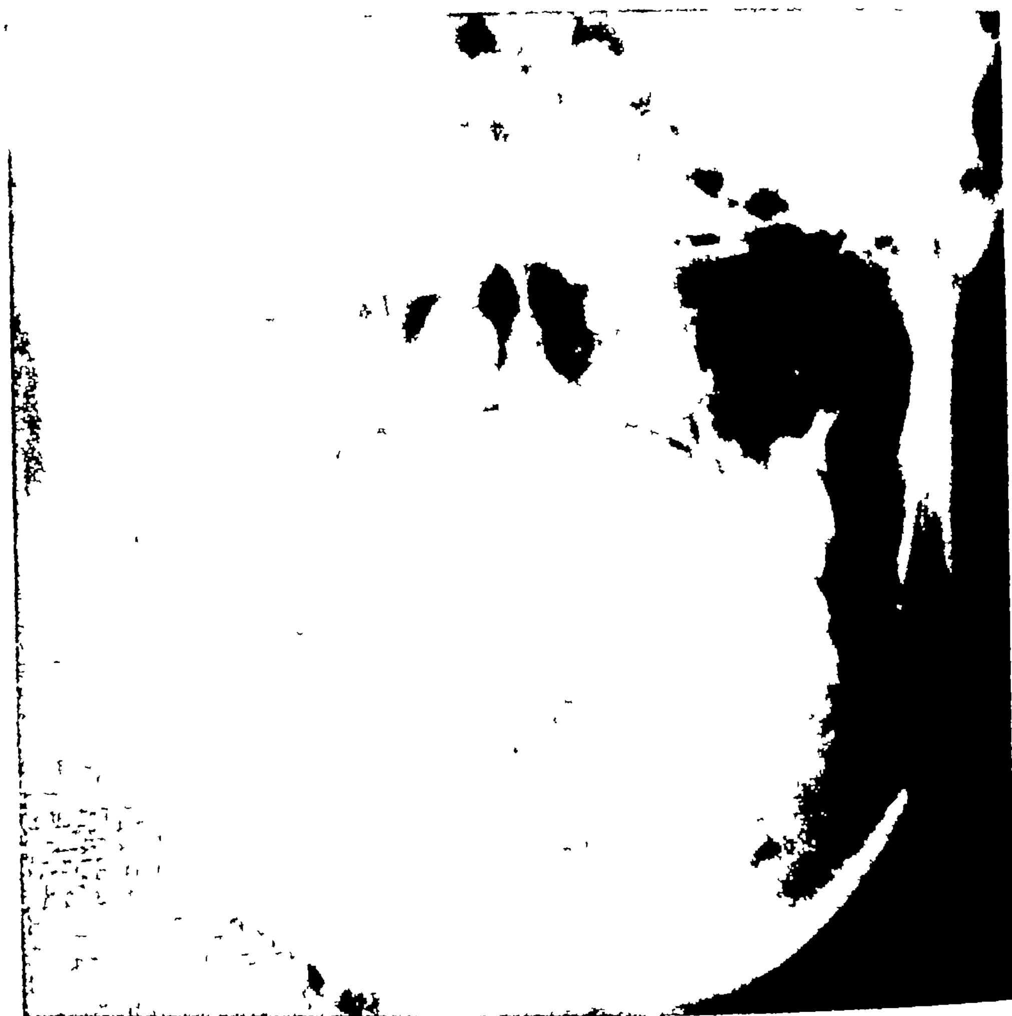


FIG. 13·10—Same patient as in Fig 13·8, showing the expansion and destruction of the ascending ramus of the mandible

ing extractions with or without curettage or minor surgical procedures Neither the signs nor symptoms are definitive in differentiating these neoplasms from other cystic and solid lesions in the jaws.

Roentgenographic Appearance

The appearances are quite variable, but more commonly a multilocular radiolucent bony defect of varying size and shape, fairly well demarcated from surrounding bone, is seen. Often there is outward expansion and thinning of the bony cortex In the small central lesions, numerous trabeculae divide the lobulated defect into more or less rounded compartments of varying sizes The periphery may be scalloped, because of uneven cortical erosion rather than because of true bony septae. In the expansile type the compartments are larger and the peripheral pattern is due to either residual or reparative bone.

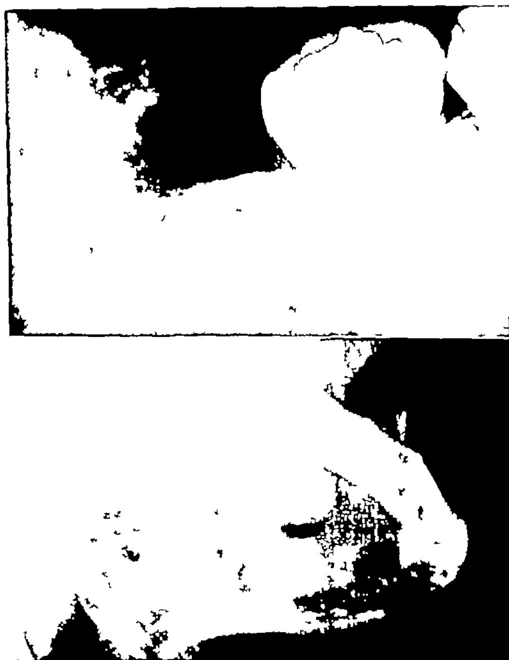


FIG 13 11 (*Upper*)—Ameloblastoma of the gingival type, as seen by the periosteal flare in the retromolar area from superficially invading tumor

FIG 13 12 (*Lower*)—Ameloblastoma of the gingival type with multiple cyst formation and beginning invasion of cortical bone.

Less commonly the defect is unilocular, the margins are less apt to have a smooth contour, are more lobulated and irregular The mandibular third molar region is the most common site where the defect may simulate one of the odontic cysts

Most ameloblastomas are in close proximity to teeth and often appear



FIG 13 13 (*Upper*)—Ameloblastoma of the gingival type with the typical scalloped invasive borders

FIG 13 14 (*Lower*)—Ameloblastoma of the gingival type with the characteristic smooth scalloped invasive margin and partial destruction of the roots of the first molar tooth

lateral to the root, or an unerupted tooth may be contained completely within the tumor, simulating a dentigerous type of follicular cyst In large lesions the roots of adjacent teeth may be enveloped, and erosion and displacement are frequent findings In the maxilla the involvement of unerupted teeth is less frequent. Although ameloblastomas here rarely attain the massive size of those in the mandible their characteristics are otherwise similar

Ameloblastomas may be frequently recognized by roentgen study, and a practical grouping, according to their peripheral or central origin, is important to the surgeon

Gingival This type arises from the crest of the alveolar ridge and bone invasion is seen as multi or unilocular radiolucent areas These spaces usually are small and the peripheral margins well defined yet they lack the condensing osseous margins of true cysts A variable amount of periosteal new bone formation is present at the margins



FIG. 13 15—Ameloblastoma of the gingival type involving alveolar bone lamina dura, root of the cuspid tooth and palatal process of the maxilla.

Medullary This type arises centrally around the roots of teeth and is most frequently multilocular in appearance Where the roots of the teeth are within the tumor area, the lamina dura is usually destroyed The tooth roots may be resorbed or displaced. The radiolucent areas are well defined, suggesting that invasion is by way of bone vascular spaces, with absorption and expansion of the cortex.

Follicular This type has the appearance of an odontic cyst, usually



Fig. 13-16 (*Upper*)—Ameloblastoma of the gingival type with typical honeycombed pattern from extensive invasion of alveolar and cortical bone.
Fig. 13-17 (*Lower*)—Ameloblastoma of the gingival type with a large multicystic area of bone destruction.

the dentigerous type Usually a localized multilocular or honeycombed area within a large unilocular cystic space is demonstrated and may or may not contain the crown of a tooth. Special roentgen techniques may be required to reveal these detailed characteristics. These may be interpreted as ameloblastomas developing in a dentigerous cyst, or mimicking such a cyst



FIG 13 18—Ameloblastoma of the gingival type with marked destruction of the maxilla but with the unusual quality of appearing to be more dense and of not having the typical cystic appearance

Carcinomatous This variety may arise *de novo* and produce the lace like pattern of destruction typical of any carcinoma invading bone More commonly carcinoma develops in an area within an ameloblastoma where small radiolucent areas are seen.

Diagnosis

After careful study of intraoral and extraoral roentgenograms made from various angles, a tentative diagnosis can be made However due consideration should be given to all possible lesions which produce radiolucent areas in the jaws The nonodontic and odontic cysts may ordinarily be excluded on the basis of these films Careful consideration should be given the peripheral and central giant-cell reparative granulomas in



FIG. 13-19 (*Upper*)—Ameloblastoma of the gingival type with extensive involvement of the molar area and tuberosity of the maxilla with bone destruction but with maintenance of coarse trabeculation

FIG. 13-20 (*Lower*)—Unicystic ameloblastoma arising in the retromolar region in relation to the unerupted third molar tooth The ill-defined margins and the partially denuded tooth root are diagnostic aids

cluding lesions of hyperparathyroidism, the giant cell tumor and the fibrous dysplasias, as well as histiocytoses

Whenever an ameloblastoma is considered in the differential diagnosis a biopsy is required. In the presence of an ulcerated growth the procedure is no problem. In the medullary type the extraction of a related tooth may furnish adherent tissue or provide an adequate opening to



FIG 13 21—Ameloblastoma of the medullary type appearing characteristically with a multicystic pattern and destruction of the root tips

obtain tumor If this procedure is not feasible, minor surgery with minimal trauma is necessary and may be accomplished without interfering with the subsequent treatment.

Treatment

The eradication of ameloblastoma is possible only by a wide surgical (en bloc) resection of the tumor including a margin of normal bone on all sides In the past, the chief deterrent to adoption of this course of therapy had been the lack of appreciation of the locally malignant character of this tumor as well as lack of knowledge of the ultimate deformity Conservative surgery curettage cautery or roentgen and radium therapy have no place in the definitive treatment. Conservative enuclea



FIG. 13-19 (*Upper*)—Ameloblastoma of the gingival type with extensive involvement of the molar area and tuberosity of the maxilla with bone destruction but with maintenance of coarse trabeculation.

FIG. 13-20 (*Lower*)—Unicystic ameloblastoma arising in the retromolar region in relation to the unerupted third molar tooth. The ill-defined margins and the partially denuded tooth root are diagnostic aids.

cluding lesions of hyperparathyroidism the giant cell tumor and the fibrous dysplasias as well as histiocytoses

Whenever an ameloblastoma is considered, in the differential diagnosis a biopsy is required In the presence of an ulcerated growth, the proce dure is no problem In the medullary type the extraction of a related tooth may furnish adherent tissue or provide an adequate opening to

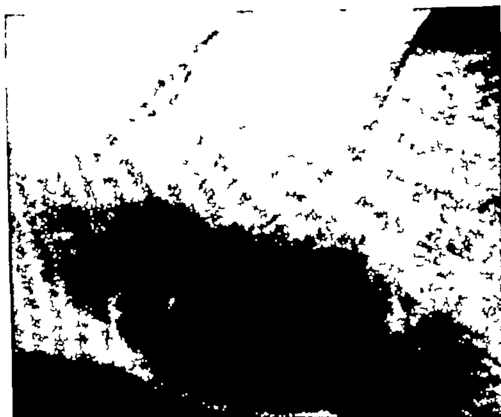


FIG 13 21—Ameloblastoma of the medullary type appearing characteristically with a multicystic pattern and destruction of the root tips.

obtain tumor If this procedure is not feasible minor surgery with minimal trauma is necessary and may be accomplished without interfer ing with the subsequent treatment.

Treatment

The eradication of ameloblastoma is possible only by a wide surgical (en bloc) resection of the tumor including a margin of normal bone on all sides. In the past, the chief deterrent to adoption of this course of therapy had been the lack of appreciation of the locally malignant char acter of this tumor as well as lack of knowledge of the ultimate de formity Conservative surgery curettage, cautery or roentgen and radium therapy have no place in the definitive treatment. Conservative enuclea

tion invariably leaves residual tumor. Efforts should be made to ablate the growth completely and thus avoid the otherwise inevitable subsequent procedures which are more deforming, and possible malignant change.

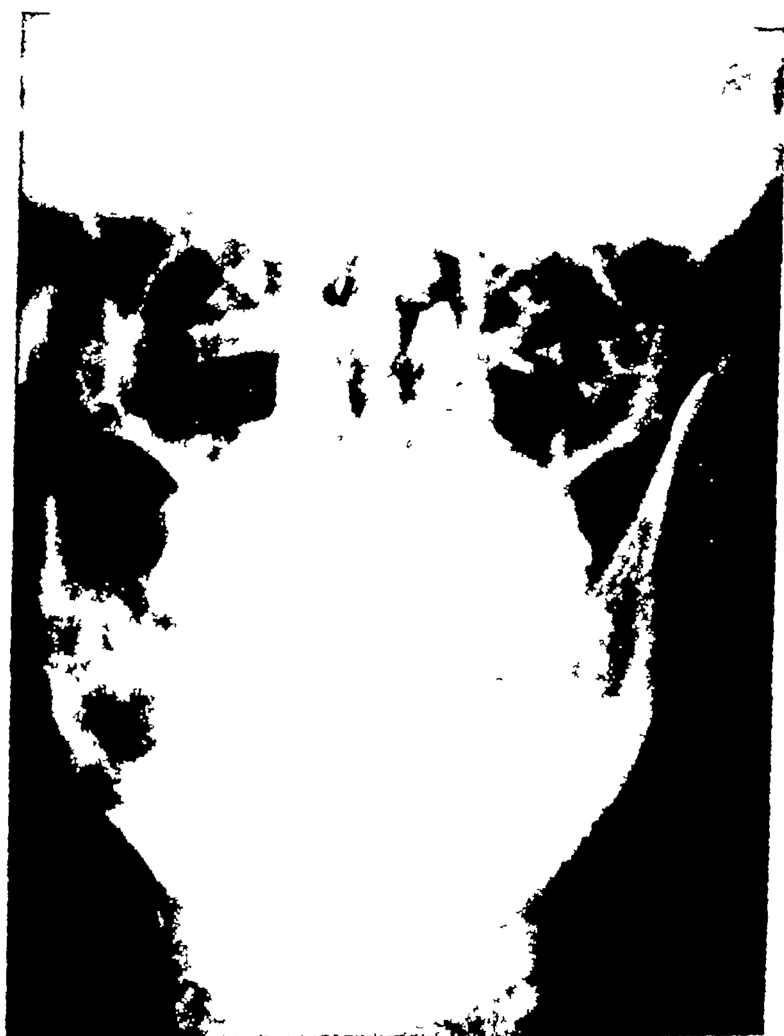


FIG. 13-22—Ameloblastoma within a follicular cyst showing a large radiolucent defect and small multicystic changes in the shell-like cortical wall of the cyst.

Prophylactic Oral Hygiene. As part of preoperative management, the treatment is instituted promptly to eliminate sepsis. The treatment of periodontal disease throughout the mouth is essential but extractions should be undertaken only for grossly infected periapical abscesses beyond the tumor area. Time is not so crucial as it is in the treatment of carcinoma, and short delay for completion of dental preparation is permissible.

Surgery. For both the ameloblastoma and the rare squamous cell carcinoma variety, surgery is indicated even though [illegible]

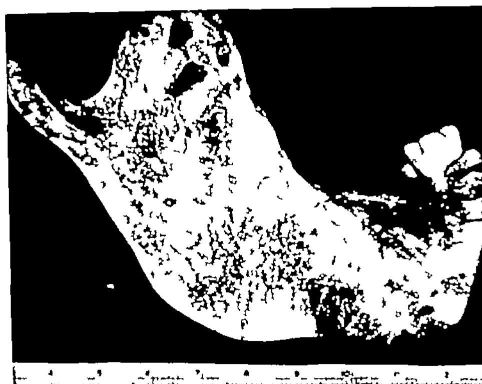


Fig 13 23—Surgical specimen from the patient in Fig 13 22 The mandible appears expanded, with a bleblike lesion along the inferior body where the ameloblastoma has invaded through the cortical bone



Fig 13 24—Ameloblastoma of the medullary type with extensive multicystic destruction of the mandible



FIG 13 25—The same patient as in Fig 13·24, showing the extension and destruction of spongiosa and cortical bone without appreciable expansion

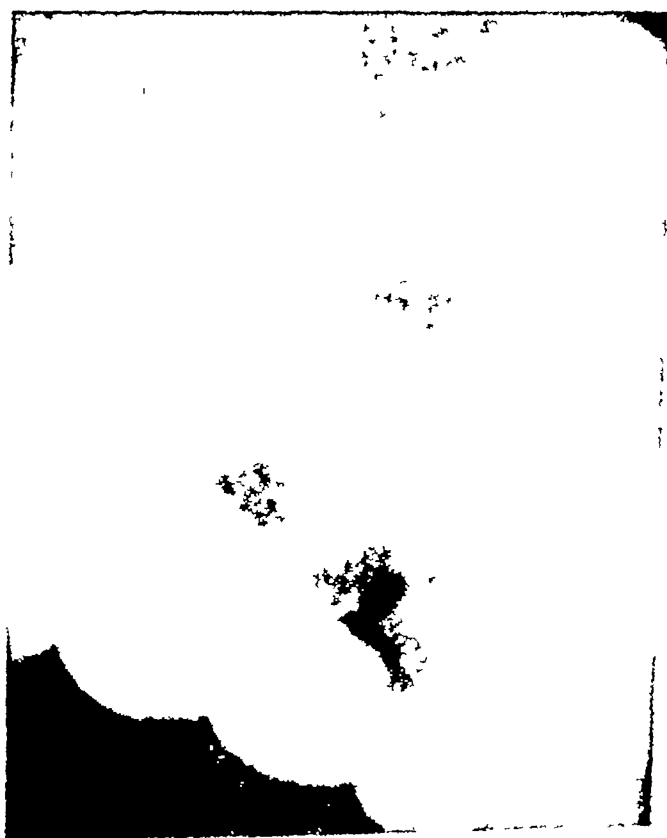


FIG 13 26 Ameloblastoma of the maxilla which has caused [illegible] tion of the teeth with residual coarse trabeculation and small cysts



FIG 13 27 (*Upper*)—Ameloblastoma of the maxilla with a diminution of the fine trabeculae, leaving the coarse trabeculae and teeth relatively undisturbed. FIG 13 28 (*Lower*)—Ameloblastoma with marked expansion of bone and destruction of tooth roots

beyond the bone itself. The only contraindications are evidences of invasion of the base of the skull, or the patient's poor physical condition.

On the basis of the clinical examination and roentgen studies, one of five possible surgical procedures may be selected.



FIG. 13-29—Ameloblastoma of the medullary type with expansion of the mandible and destruction of the roots of the remaining molar tooth.

arches. Metal or plastic splints may be more appropriate in certain cases.

4 *External hemiresection* of the mandible with a radical neck dissection is indicated for the carcinomatous type of growth involving the mandible The limiting factors of operability are discussed under Lesions of the Gingivae (Chap 9)



FIG 13 30—Ameloblastoma of long duration with complete destruction and distortion of the bone

5 *Total resection of the maxilla* with the contents of the orbit is indicated for the majority of the extensive ameloblastomas and for all with carcinomatous changes An accompanying radical neck dissection is indicated only if cervical nodes are clinically demonstrated to be involved.

Prognosis

The prognosis is dependent on the prompt establishment of a definite

beyond the bone itself The only contraindications are evidences of invasion of the base of the skull, or the patient's poor physical condition

On the basis of the clinical examination and roentgen studies, one of five possible surgical procedures may be selected



FIG 13 29—Ameloblastoma of the medullary type with expansion of the mandible and destruction of the roots of the remaining molar tooth

1 *Partial resection* of the alveolar ridge for the early superficial lesion occurring on the crest where the roentgen evidences of invasion are confined to alveolar bone A block specimen should be removed with at least a 1 0-cm margin of normal bone on all sides

2 *Intraoral hemiresection* is indicated in the mandible for larger lesions which are still confined within the bone, and in the maxilla when the disease is confined to the lower half

3 *External partial resection* of the mandible with immediate bone graft is indicated for more extensive tumors where it is possible to adapt an immediate graft for maintenance of normal alignment of the dental

arches Metal or plastic splints may be more appropriate in certain cases.

4 *External hemiresection* of the mandible with a radical neck dissection is indicated for the carcinomatous type of growth involving the man dible The limiting factors of operability are discussed under Lesions of the Gingivae (Chap 9)



FIG 13 30—Ameloblastoma of long duration with complete destruction and distortion of the bone

5 *Total resection of the maxilla* with the contents of the orbit is indi cated for the majority of the extensive ameloblastomas and for all with carcinomatous changes An accompanying radical neck dissection is indicated only if cervical nodes are clinically demonstrated to be involved

Prognosis

The prognosis is dependent on the prompt establishment of a definite biopsy proved diagnosis, and the initial radical en bloc resection well

beyond the boundaries of the tumor—with or without reconstructive surgery. Prognosis is affected by factors which delay proper diagnosis and treatment.

1 Omission of roentgen studies prior to extraction or minor surgery
2 Failure to have pathologic studies made of tissue removed, particularly of innocent-appearing granulations at the apices of extracted teeth.



FIG. 13 31—Ameloblastoma of a medullary type with large multicystic appearance involving the angle and ramus with minimal expansion

3 Reliance on curettage or minor surgical excision of histologically proved ameloblastomas

The prognosis for the carcinomatous variety is less favorable than for squamous carcinoma of the gingiva

OTHER CENTRAL EPITHELIAL TUMORS

Certain rare benign and malignant tumors of epithelial origin arise centrally within the jaws. Squamous carcinoma is found occasionally to arise in epithelium of nonodontic and odontic cysts odontic tumors granulomas and residual epithelial elements Even more rarely residual



FIG 13 32—Ameloblastoma of a medullary type involving the central portion of the body of the mandible with extensive destruction of cortical bone and invasion through the interior surface.

glandular remnants may give rise to adenomas and adenocarcinomas The much more common gingival carcinoma invading the jaw and the metastatic carcinoma are discussed elsewhere (Chaps. 9 and 18)

Primary Central Epidermoid Carcinoma

These rare tumors arise from central epithelial elements, and their histologic appearance is indistinguishable from that of squamous carcinoma elsewhere in the body Usually they arise in the medullary cavity and as they grow they destroy bone.

A toothache or paresthesia may be an early complaint. The symptoms usually are not prominent until considerable bone has been destroyed. Progress is usually rapid, with loosening of the teeth, bulging of the cortex, and ultimately ulceration.

The early roentgenographic findings are not diagnostic, but any sign of an osteolytic process without new bone formation should indicate a surgical exploration.

The treatment consists of a radical resection for all operable cases, similar to the procedures described for gingival carcinoma (Chap 9)



FIG 13·33—The same patient as shown in Fig 13·32 The expansile process is well demonstrated in this view

Central Salivary Gland Tumors (Central Adenoma)

These tumors are extremely rare and are usually stated to arise from enclaved salivary gland elements, although origin from the epithelial linings of nonodontic and odontic cysts cannot be completely excluded

The histopathology of these tumors is subject to wide structural variations including the adenoma of a simple glandular type, the so-called mixed tumors, and the adenocarcinomas In the adenomas the cell form is usually pyramidal, and an attempt is made on the part of the tissue

to form lumina which do not contain mucoid secretion In mixed tumors the epithelial structure is formed by cuboidal cells in tubules columns and nests in varying amounts of altered epithelial secretion and connec tive tissue giving a pseudocartilaginous appearance

The symptoms are those of a benign local aggressive lesion. Ultimately there is destruction of the cortex, with ulceration.



FIG 13 34—Ameloblastoma of a medullary type extending from the symphysis posteriorly to the coronoid process. The expansion and distortion of the teeth are prominent features.

On roentgenographic study a unilocular radiolucent zone is seen sim ulating an osteolytic tumor The peripheral margin may not be well defined, in which case possible malignant changes should be considered

Surgical removal is the method of choice and one of the techniques for partial resection of the jaw should be used

Central Adenocarcinoma

Adenocarcinoma arises extremely rarely in the central or medullary cavity of the jaws and is usually an adenoid cystic carcinoma while the mucoepidermoid and simple adenocarcinomas are even more rare.



FIG 13 35—The same patient as in Fig 13 34 from a lateral position showing the irregular destruction of cortical bone



FIG 13 36—Ameloblastoma with a marked expansion and [illegible] lines a variety of cystic patterns



FIG 13 37 (*Upper*)—Lateral views of an ameloblastoma involving entire body of the left mandible and including the anterior third of the right

FIG 13 38 (*Lower*)—Laterial view of an ameloblastoma involving the anterior two-thirds of both sides of the mandible



FIG 13·35—The same patient as in Fig 13·34, from a lateral position showing the irregular destruction of cortical bone



FIG 13 36—Ameloblastoma with a marked expansion and the altered bone outlines a variety of cystic patterns



FIG 13 37 (*Upper*)—Lateral views of an ameloblastoma involving entire body of the left mandible and including the anterior third of the right.

FIG 13 38 (*Lower*)—Lateral view of an ameloblastoma involving the anterior two-thirds of both sides of the mandible

The histopathology of the adenoid cystic carcinoma is characterized by a monotony of small round cells secreting a variable amount of mucin and separated into cylinders by hyalinized connective tissue The pooling of the mucoid secretions separates the cells into microcysts of irregular sizes The mucoepidermoid variety, however, has ductal structures



FIG 13 39—Ameloblastoma which, except for an indefinite margin and erosion of roots of teeth, simulates a follicular cyst

formed from a mixture of goblet, columnar, and epidermoid and intermediate cells Where the latter predominate, the malignant potential is greatest The least frequently encountered tumor in this group is the mucus-secreting adenocarcinoma, the structure of which is composed of tall columnar and goblet cells similar to those arising in the mucous membranes of the gastrointestinal tract

The roentgenographic findings in the three types are those of an osteolytic tumor with an irregular lacelike margin produced by invasion of the cortex Expansion and sclerotic margins are not visualized The treatment is a wide surgical resection



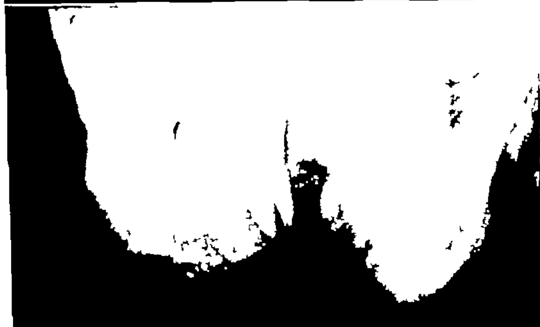


FIG 13 40 (*Upper*)—A surgical specimen which has been sectioned longitudinally and reflected.

FIG 13 41 (*Lower*)—Anaplastic carcinomatous variety of an ameloblastoma with marked destruction of bone indistinguishable from gingival carcinomatous invasion.



FIG 13 42 (*Left*)—An ameloblastoma of the gingival type invading the alveolar bone and partially surrounding and destroying the roots of the middle and lateral incisive and canine teeth

FIG 13 43 (*Center*)—The patient in Fig 13 42 four months after surgical exposure and curettage

FIG 13 44 (*Right*)—The same patient as in Fig 13 42 eighteen months after the curettage New bone is being laid down but with slight evidence of cystic change throughout the radiolucent area

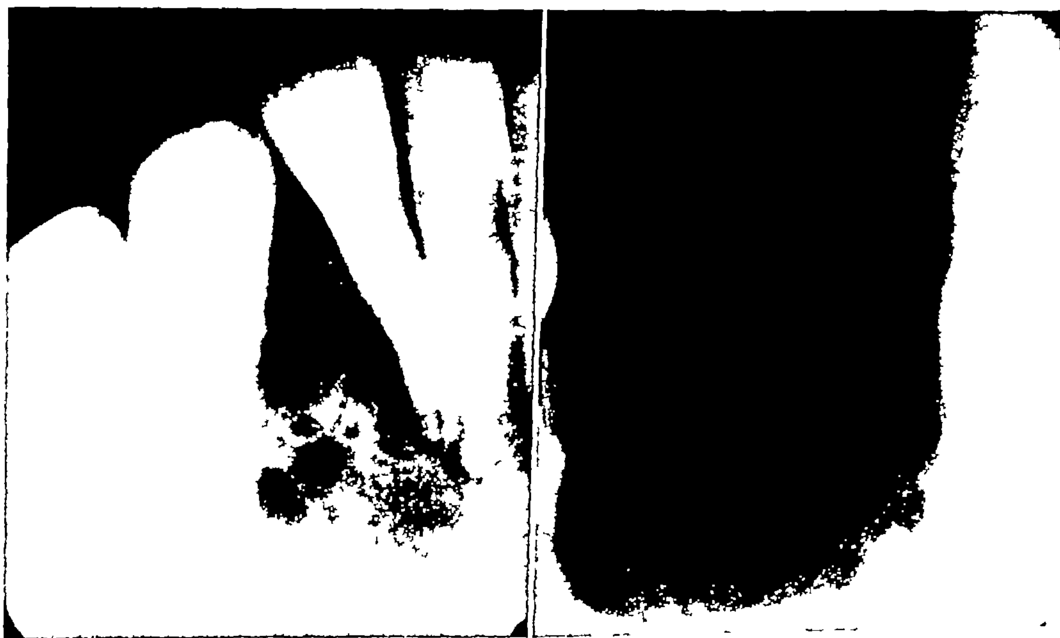


FIG 13 45 (*Left*)—The same patient as in Fig 13 42 eight years later, showing the recurrent tumor with invasion beyond the limits of the initial roentgenogram and extensive resorption of tooth roots A block resection involving two incisors and the canine tooth was accomplished

FIG 13 46 (*Right*)—The same patient as in Fig 13 42 four years after block resection, showing new bone laid down along the inferior border of the mandible.



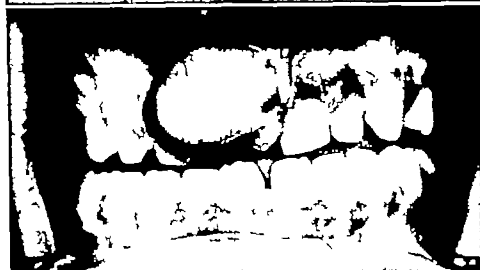


FIG 13 47 (*Upper*)—Carcinoma arising in minor salivary gland
FIG 13 48 (*Lower*)—Keratoacanthoma



FIG 13 49—Mixed tumor of minor salivary gland origin invading alveolar and cortical bone and roots of several teeth

Retinal Anlage Tumor

This is an exceedingly rare benign tumor of the skull It ha been reported in the anterior fontanel and in the maxilla It is to be an embryologic tumor derived from and attempting to forn tissue

In the maxilla these tumors may produce bone destruction alveolar process and adjacent hard palate, but are encapsulat overlying mucous membrane is dusky red and may be partially ul The tumor is semifirm and on sectioning reveals pigmentation from gray-blue to black with small areas of white Microscopic tumor is composed of three types of *neuroectodermal tissue*—pig cells, neuroblasts, and spindle cells

The treatment is surgical excision The prognosis is good.

READING REFERENCES

AISENBERG, M S "Histopathology of ameloblastoma," *Oral Surg Or Oral Pathol* 6.1111–1128 (1953)

BACLESSE, F, and G LETOUZE "Considerations radio-cliniques à pro 14 cas d'adamantinomes," *Presse méd* 58 372–374 (1950)

BAKER, P L, M B DOCKERTY, and M B COVENTRY "Adamantinoi called) of long bones review of the literature and a report of thi cases," *J Bone and Joint Surg* 36A 704–720 (1954)

BERNIER, J L, and R W TIECKE "A compilation of material recei the Registry of Oral Pathology," *J Oral Surg* 9 341–348 (1951)

FLEMING, H S. "Homologous and heterologous intraocular growth o planted tooth germs," *J Dental Research* 31 166–188 (1952)

HERTZ, J "Adamantinoma, histopathologic and prognostic studies," *Act Scand* 102.405–435 (1952)

LEFKOWITZ, W, C F BODECKER, and D F MARDFIN "Odontogenesi molar prenatal stage," *J Dental Research* 32·749–772 (1952)

LUCAS, R. B, and A C THACKRAY "The histology of the adamanti *Brit J Cancer* 5 289–300 (1951)

MANLEY, E B "Adamantinoma in relation to tooth development" *Au J Dentistry* 58:141–198 (1954)

MARTIN, H E, and F W FOOTE, JR "A third case of so-called retinal tumor," *Cancer* 4 86–91 (1951).

ROBINSON, H. B G "Ameloblastoma survey of 379 cases" *Arch* 23 831–843 (1937)

SHARP, G S, W K BULLOCK, and F C BINKLEY "Ameloblastoma jaws," *Oral Surg Oral Med Oral Pathol* 8 1013–1025 (1955)

SONESSON, A "Odontogenic cysts and cystic tumours of the jaws," *Acta Suppl.* 81:1–159 (1950)

THOMA, K. H. and H. M. GOLDMAN. "Odontogenic tumors: a classification based on observations of the epithelial, mesenchymal, and mixed varieties." *Am. J. Pathol.* 22:433–471 (1946).

ZEGARELLI, E. V. "Adamantoblastomas in the Slye stock of mice." *Am. J. Pathol.* 20:23–87 (1944).

CHAPTER 14

Benign Neoplasms of Connective Tissue

Confusion exists in the literature because of the multiplicity of terms used to describe central lesions of connective-tissue origin arising in the jaw The term *central fibroma* has been used as a broad inclusive term to name a number of lesions which vary markedly in their histologic pattern

The so-called central fibroma is erroneously described as the lesion of origin for such diverse conditions as fibrous dysplasia, cementoma, dentinoma, osteogenic fibroma, odontogenic fibroma, and myxoma Such a bizarre pathogenesis has not been described for pathologic processes in any other skeletal region Although the pathogenesis of these central jaw lesions is quite debatable and their structure variously interpreted, we consider the following lesions as distinct and separate entities central fibroma, fibromyxoma, nonosteogenic fibroma, and chondromyxofibroma These tumors are in no way to be confused with the varied group of lesions which make up fibrous dysplasia

All these tumors arise within the medullary space from bone marrow connective tissue and may be either odontic or nonodontic in position The basic cellular elements are the fibroblasts, some of which retain the histologic characteristics of the mature fibroblast, others are more immature, while still others are stellate in form (associated with myxomatous change) In addition, chondroid and osseous metaplasia may occur

The origin of the noncellular elements (matrix) of these tumors will be better understood if a brief review of their physiologic production is given All tissues of the body are composed of three types of materials (1) cells, (2) intercellular substances, (3) fluids The intercellular substances for the most part are composed of varying portions of formed and amorphous types The formed elements are the collagenic, reticular, and elastic fibers The amorphous elements are the ground and cement substances The origin of both the fibrillar and amorphous types is closely related to the fibroblast, but the exact role it plays in their formation is not definitely understood The fibroblast, as well as the fibrillar inter-

cellular substances is embedded in the amorphous material. The latter is in the form of a sol (soft ground substance) or a gel (firm cement substance) the difference depending on the chemical structure The amorphous intercellular substances are spoken of collectively as mucopolysaccharides and are composed of equimolar hexosamine and glucuronic acid combined with some form of protein. There are at least two mucopolysaccharides in the amorphous intercellular material. They are distinguished from each other by the presence of sulfuric acid on the hexosamine part of the molecule. The predominant intercellular amorphous material is the sulfated type and the only type without a sulfate radical is hyaluronic acid. The sulfated type is more viscous than hyaluronic acid and is present in the tissues as a gel. This is known as the cement substance. It is the matrix component providing support for cartilage and is the site where the crystalline material is deposited in bone.

This group of tumors some of which are peculiar to the jaws is subject to alteration in the chemical composition of the matrix component. These chemical substances are products of the fibroblast or its metaplastic derivants such as chondroblast or osteoblast.

As far as is known there is no such cell in these lesions as a myxoblast, and myxomatous change is the product of the principal cellular element of each specific tumor in this group

Pathology

Central Fibroma This lesion is essentially similar to the fibroma appearing elsewhere in soft tissue A rare tumor it arises in the medullary cavity from connective tissue and may or may not be positionally related to the teeth. Grossly the tumor is encapsulated and is usually less than 2 cm in its greatest dimension but may become massive in which case there is marked distortion of the mandible. The tissue is gray white in color hard in consistency and without cyst formation or necrosis Microscopically the cellular structure is homogeneous composed of mature connective tissue cells with a crisscross arrangement of the fiber bundles The bone surrounding the fibroma is normal but has a dense sclerotic margin. The circumscription noted on gross inspection is deceptive for microscopically extension at different sites into the adjacent bone is seen to be frequent. This tumor may occasionally develop metaplastic bone or myxomatous changes If the latter changes are marked it cannot be differentiated from the fibromyxoma.

Fibromyxoma This growth likewise has a counterpart in the peripheral soft tissues. It is another rare neoplasm of the jaws and is usually related to the teeth. In many cases of fibromyxoma a tooth is missing Grossly the tumor is usually 1 to 2 cm in greatest dimension but occasionally may

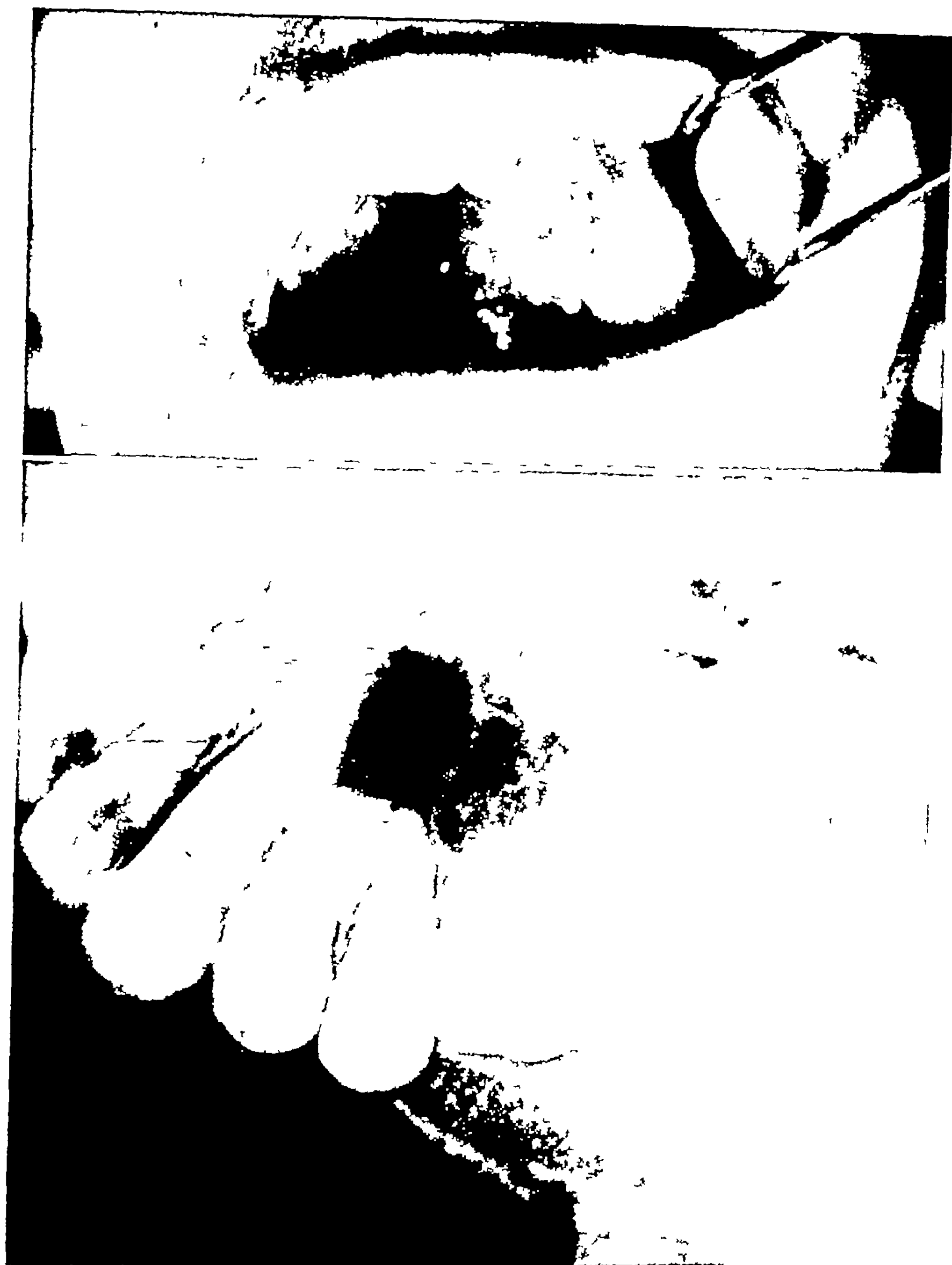


FIG 14 1 (*Upper*)—Fibromyxoma producing an equal expansion of the alveolus in both a buccal and a palatal direction The involved teeth are displaced medially

FIG 14 2 (*Lower*)—Same case as in Fig 14 1, with a multiloculated radiolucent defect extending from the cuspid to the tuberosity The trabeculae tend to be somewhat straighter than in ameloblastoma

be much larger The color varies from gray to blue white and the consistency from soft to firm depending on the fibrous component. Fibromyxomas have ill-defined margins The cut surface is viscid and slimy Microscopically large areas are devoid of fibrillar elements The predominant cell is stellate sparsely distributed and embedded in a myxoid substance In other areas the cells are more spindle-formed and in some parts a mature connective component is present Some tumors present areas which mimic the fibroblasts of the dental pulp A pure myxoma without some fibrous elements is an exceedingly rare tumor of the jaws These tumors occasionally form metaplastic bone

Nonosteogenic Fibroma This tumor of the jaws is identical with its more common counterpart, usually located in the tibia. On gross examination the tumor tissue is usually seen to be firm, fibrous connective tissue ranging in color from a gray yellow through yellow brown or red, depending on the amount of necrosis or hemorrhage. There is usually thin cortical bone over some of the individual foci, while in other areas the cortex is quite thick and sclerotic with endosteal erosion On microscopic examination the basic structure proves to be whorled bundles of spindle-celled connective tissue This tissue is usually altered by hemorrhage, either recent or old, with the spindle cells containing hemosiderin and fat. In some areas many multinuclear giant cells apparently derived from the connective tissue are noted The degree of histologic changes varies from place to place and from tumor to tumor and in some there are large areas in which giant cells and foam cells are prominent. Collagenization varies being prominent in the more ancient lesions

Chondromyxoid Fibroma This fibroma is a rare tumor occurring in the long and tubular bones although as yet it has not been described as occurring in the jaws It is apparently derived from bone marrow connective tissue and is a mixture of fibrous chondroid, and myxoid structures.

The gross appearance of this benign tumor is white to tan in color firm and resilient in consistency When sectioned there is no grittiness for bone is not formed and no trabeculae remain in the invaded spongy bone. The tumor expands the bone by thinning or eroding the cortex, but is confined by periosteum In other areas the cortex is sclerotic and irregularly eroded. On microscopic examination the basic cell is seen to be spindle shaped, widely dispersed within a myxoid intercellular matrix The nuclei of the connective tissue cells vary in shape from spindle to stellate with the fibrillar processes dispersed in an irregular manner This type of tissue tends to be pseudolobulated, because marginal zones of connective-tissue septa are interspersed between the chondroid and myxoid elements and are more dense and vascularized. Here the nuclei of the

cells and density of the collagen are more prominent Adjacent to these marginal areas similar cells appear to be within the lacunae in a chondroid matrix In these more cellular areas the nuclei are not only plump but may be multiple, as well as being associated with numerous multinucleated giant cells, hemosiderin-laden cells, and occasionally nests of foam cells

Clinical Characteristics

These neoplasms are benign in their clinical course and usually remain asymptomatic for years They usually occur in adolescents and young adults and are equally distributed between the sexes The slowly progressive pattern is particularly true of the central fibroma, while that of the fibromyxoma is more varied The latter may remain asymptomatic for long periods but frequently produces early persistent local pain Certain of those with myxomatous features have a tendency to progress to large expansile lesions and cause persistent pain, paresthesia, and deformity The chondromyxoid fibroma has not been described in the jaws

Roentgenographic Appearance

The members of this group are predominantly fibrous and myxomatous in character and present radiolucent areas with well-defined and sharp peripheral borders The central fibroma frequently has, in addition, a sclerotic margin The central fibroma and the fibromyxoma may be either odontic or nonodontic in location, and they are characteristically seen in the mandible The radiolucency of most of these tumors is not so striking or so homogeneous as that seen in unilocular cysts, although it is frequently impossible to distinguish them in the periapical locations from periodontal cysts They may be unicystic or, more commonly, multiloculated with a somewhat honeycomb appearance Erosion of the cortex produces a pseudoseptal appearance which may be either fine or coarse but is characteristically straight when compared with the markings of an ameloblastoma

The central fibroma tends to remain relatively smaller than a fibromyxoma, but either may expand the jaw These large defects retain their multicystic appearance and are usually distinguishable from fibrous dysplasia

Diagnosis

The members of this group cannot be differentiated on the basis of clinicoroentgenographic findings, and it is only on presumptive evidence that they are recognized from other osteolytic conditions in the jaws Surgical exploration is indicated for diagnosis

Treatment

The treatment for this group of tumors is the same as for all nonodontic or odontic radiolucent lesions of the jaws. The central fibromas and the small fibromyxomas can be readily removed by curetment. Larger lesions require a partial resection of the jaw well beyond the roentgenographic limits of the tumor In most cases it is possible to perform a replacement bone graft The prognosis is good and recurrence is rare.

THE CHONDROMAS

The chondromas are benign cartilaginous tumors which may be sit uated within the bone (enchondromas) or on the surface (osteochon dromas) While of common occurrence elsewhere in the skeleton where they may be multiple or solitary in the jaws they are rare and solitary

Pathology

These lesions are thought by some to be derived from cartilaginous rests, while others believe that they arise *de novo* from chondrogenic tissue. In the mandible there is a small focus of cartilage usually in the symphysis, premolar angle, coronoid and condyloid portions, and in the maxilla, the inferior turbinate the ethmoid, and the canine fossa.

The solitary type of enchondroma is most commonly noted in the phalanges and metacarpals from long bones such as humerus femur and tibia, and from sternum metatarsals and jaws Any bone preformed in cartilage can be involved. Those in the small bones of the extremities and in the jaw grow slowly Most lesions begin in childhood and be come quiescent and self limiting unless malignant change takes place. Those that attain considerable size have probably undergone transforma tion into chondrosarcoma

Osteochondromas most commonly arise in the tendinous insertions of the long bones pelvis, and jaws In the latter they may occur in the cartilaginous centers as well. The most common sites are the coronoid and condyloid processes and the ramus In contrast to the enchondromas occurring in the jaws osteochondromas have not been observed to undergo sarcomatous change.

Enchondroma On gross examination of cureted tissue it is seen to vary from small white slippery fragments to large pieces of blue-white cartilage. There may be grittiness due to calcific or bony deposits On microscopic examination the tissues may or may not show calcific or bony foci. The cartilaginous cells are usually divided into lobules by connective-tissue septa growing in from the periphery of the tumor in which capillaries are present Bizarre nuclei, abnormal nuclear cyto-

months to two years prior to the first examination Local swelling is usually not noticed, although localized point tenderness is characteristic.

Roentgenographic Appearance

The lesion may be difficult to demonstrate roentgenographically in the jaws during its early stage of development. A complaint which includes distressing pain and point tenderness without roentgenographically demonstrable changes should be suspected of being an osteoid osteoma These findings require systematic roentgenographic follow up with special emphasis on exposure and multiple angles

The classic roentgenographic appearance of the osteoid osteoma is that of a partially radiolucent defect 0 5 to 2.0 cm in diameter round or oval with structureless loss of bone The reaction around the defect varies from a thin sclerotic ring to bone so dense that the central rarefication is not visualized If it is located just beneath the periosteum abundant reactive bone formation results in an asymmetrical thickening The center of the defect frequently calcifies, and the appearance is that of a calcified central density (nidus) surrounded by a rarefied zone with the entire lesion enclosed in a sclerotic ring of bone.

Treatment

The surgical exposure and complete removal of the nidus by thorough curettage will effect a cure with relief of pain

READING REFERENCES

BLUM T Cartilage tumors of the jaws" *Oral Surg Oral Med Oral Pathol* 7:1320–1334 (1954)

CALKINS, E M SOODAK, and W BAUER "Medical progress metabolism and clinical significance of the carbohydrate components of connective tissue" *New Engl J Med* 253:865–871 (1955)

FOSS, E L M B DOCKERTY and C A GOOD "Osteoid osteoma of the mandible report of a case," *Cancer* 8:592–594 (1955)

JAFFE, H L. "Osteoid osteoma," *Proc Roy Soc Med* 46:1007–1012 (1953)

JAFFE, H L., and L. LICHTENSTEIN "Non-osteogenic fibroma of bone" *Am J Pathol* 18:205–221 (1942)

JAFFE, H L., and L LICHTENSTEIN "Chondromyxoid fibroma of bone" *Arch Pathol* 45:541–551 (1948)

LOFGREN L. "Osteoid osteoma," *Acta Chir Scand* 104:383–404 (1953)

CHAPTER 15

Malignant Neoplasms of Connective Tissue

OSTEOGENIC SARCOMA

A triad of neoplasms of the jaws is included under this term osteo-chondro-, and fibrosarcoma Each has a distinct clinical, roentgenographic, and histologic appearance

Incidence

It is difficult to obtain the frequency in occurrence of the various types of osteogenic sarcomas of the jaws The osteosarcomas are the more frequent, with the fibrosarcoma and chondrosarcoma coming next in that order Males and females are affected equally which is in contrast to their counterparts in other regions of the skeleton where males are more often affected The age of occurrence for osteo- and chondrosarcoma is from fifteen to twenty-five years, and for fibrosarcoma, twenty-five to fifty years

Etiology

The etiology is unknown, but certain of the osteogenic sarcomas are associated with radium poisoning, excessive roentgen-ray exposure, and such diseases as fibrous dysplasia, giant-cell tumors and Paget's disease

Pathology

The osteosarcomas arise from the osteogenic tissue in the cancellous portion of bone, most commonly in the metaphyseal regions of bones around the knees They may, however, occur in any of the bones, but when affecting the jaw bones approximately half will involve the alveolar ridges and may displace teeth They cause little expansion of the involved bone but soon destroy and extend outward at first raising the periosteum and later perforating it to reach adjacent soft parts and other structures Epiphyseal or articular cartilage is resistant to invasion by these tumors

The consistency and appearance vary according to the amount of matrix formed the extent of invasion, the duration of the growth and the amount of necrosis The osteolytic lesion will have less matrix, more stroma, and more necrosis hemorrhage and cystic softening The more sclerotizing lesion will have less stroma more matrix, and fewer second ary changes The various tumors range between these two extremes In any given tumor the most sclerotic portion is usually centrally situated, but randomly scattered foci of hardened tissue are also usually present. If a tumor is sclerotic, it is so from the beginning Over half these tumors are of the sclerosing type

Various names have been given to the different anatomic types of tumors such as sclerosing telangiectatic, etc but these have no bearing on the biologic behavior of the tumors and, since they seem only to confuse, should be discarded

Microscopically the structural characteristics are so variable that no two of these tumors are alike The basic tissue component is a malignant stroma with tumor osteoid and bone A malignant cartilage component may be present in varying amounts but is not necessary for a diagnosis When such a cartilage component is present, however it may be calcified, ossified, or myxomatous

The *chondrosarcomas* are the most rare of the osteogenic sarcomas In contrast to sarcomas in other skeletal sites the majority of which arise from enchondromas or osteochondromas those occurring in the jaws apparently arise *de novo* from mesenchyme or cartilaginous rem nants They usually arise in the medullary portions of the maxillae and less frequently in the mandible They have the same aggressive course as the other sarcomas The sarcomatous tissue is friable glistening white with large portions that are gelatinous Calcific foci are common. Microscopically the criteria as to whether a cartilage tumor is malignant are based on cytologic changes seen in a noncalcified area. Numerous his tologic sections may be necessary before such cell changes are noted The altered cells have plump nuclei, two or more nuclei to a lacuna bizarre cellular forms, and mitoses.

Fibrosarcomas arise from the bone marrow connective tissue do not produce tumor osteoid, bone or cartilage in either the primary or me tastatic sites Periosteal fibrosarcomas if they do exist, are extremely rare and most growths which are thought to be of this type are usually from adjacent soft parts. Such peripherally situated tumors can and do invade bone. The gross appearance mode of growth, and destruction of the bone differ little from those of the more cellular osteosarcomas The diagnosis as with other neoplasms depends on the microscopic findings The tumors are composed of malignant spindle cells resembling

fibroblasts, with varying degrees of anaplasia mitoses, and degenerative changes. Certain types of medullary fibrosarcomas are composed of sheets of bizarre, large, non-spindle-shaped cells with an appearance more ominous than their biologic behavior

Clinical Characteristics

The symptomatology is the same for these sarcomas as for all malignant skeletal tumors The primary complaint is of pain and aching in the affected bone It is usually intermittent and fleeting at first but soon becomes severe and constant Because of the similarity of its symptoms to those of sinusitis, a growth in the maxilla is usually advanced when detected Swelling or tumefaction, absent at first soon appears, with ulceration and widening of the gingiva, and displacement and loosening of the teeth Because of the usual presence of superimposed infection, the tumor may simulate an osteomyelitis

With progression of the disease the swelling increases rapidly, producing a distortion of the facies indistinguishable from that caused by carcinoma of the antrum Metastases to the lungs occur earlier in the course of osteo- and chondrosarcoma than in fibrosarcoma

Roentgenographic Appearance

Certain roentgenographic appearances, such as irregular destruction of spongiosa and cortex, lack of a well-defined margin, tendency to destroy without expansion of the cortex, formation of osteoblastic tumor tissue in surrounding soft tissues with splitting lamellation or vertical spicule patterns, are common for osteosarcoma, as well as for many malignant skeletal tumors These more typical appearances of osteosarcoma, as seen elsewhere in the skeleton, are frequently absent in the jaws The so-called sunray or sunburst seen in other sites is rare in the jaws This is a nonspecific phenomenon and may be seen in other neoplasms or inflammatory conditions Chondrosarcomas have an irregularly outlined density with foci of more dense calcification Fibrosarcomas are osteolytic and the roentgenogram shows this process only with ill-defined, irregular margins Roentgenographic examination of the resected specimen at the time of surgery, particularly of the mandible serves as an aid to surgical judgment in defining margins of safety

Diagnosis

The history and physical findings may be suggestive of sinusitis, osteomyelitis, or Ewing's sarcoma The roentgenograms are not always helpful in the differential diagnosis The final diagnosis is made by biopsy, tissue being obtained from the site of ulceration, if present, if absent, adequate tumor tissue must be obtained.

Treatment

The primary operable lesion without demonstrable pulmonary metastases, is treated by prompt radical resection

Prognosis

The prognosis for osteo- and chondrosarcoma is uniformly bad, while fibrosarcoma offers a much better chance of a five year survival.

GIANT CELL TUMOR (OSTEOCLASTOMA)

The true central giant-cell tumor of the jaws is an extremely rare neoplasm and differs in no way from its skeletal counterpart, more commonly found in the epiphyseal region of long bones These genuine tumors have in the past been confused with osteitis fibrosa cystica of hyperparathyroidism, central giant-cell reparative granuloma, ameloblastoma, fibrous dysplasia, and other less serious rare lesions of the jaws The characteristic histologic features of this tumor are now more precisely defined and may readily be distinguished from those of all other osseous lesions.

Incidence

The majority of the giant-cell lesions of the jaws are not true central giant-cell tumors, and only a few authenticated cases of the latter are reported in the literature

This neoplasm is rare in patients under the age of twenty years the highest incidence is between the ages of twenty and thirty five years The sexes are affected equally

Etiology

Various theories as to etiology and histogenesis have been proposed, but none has been definitely substantiated The lesion is a neoplastic process most probably arising in the bone marrow from the precursor of the osteoclast. However some believe it to arise from non bone forming connective tissue Trauma is a commonly related factor but its importance to the genesis of this lesion is difficult to evaluate

Pathology

Giant-cell tumors are solitary lesions which may be found in practically any bone except membranous bones in the skeleton. They occur particularly in the cancellous bone in the epiphyseal region (the end of the bone and adjacent metaphysis) of long bones and approximately 50

per cent occur around the knee In the skull, the symphysis the premolar area, and the coronoid process of the mandible the canine fossa and ethmoid region in the maxilla, as well as the sphenoid bone, are sites of predilection

The neoplastic process causes an erosion and expansion of the cortex The periosteum is usually not destroyed but remains as a limiting membrane The joint cartilage is likewise a natural barrier There is no bone formation within the tumor area, but at the periphery periosteal new bone does occur In the lower jaw these tumors are locally destructive and when appearing in the maxilla and adjacent structures, they often invade the sinuses, nares and orbit The gross appearance is that of a neoplastic expansile lesion fairly well demarcated from adjacent structures Sections made by cutting vary in their appearance according to the secondary changes, although, characteristically, fibrosis hemorrhage and cyst formation are visible The color is not always uniform, more typically it is a red-brown with an occasional area of gray or yellow-brown Where the tumor is more cellular, degeneration or necrosis is more common and the color is more variegated

Microscopic confirmation depends on finding a large number of giant cells in a spindle-cell stroma, the latter, however is the important factor in evaluating the degree of malignancy The giant cells contain nuclei similar to those found in the stromal cells and if searched for, usually the latter can be seen entering into the tumor giant cells They are thought to be osteoclasts The nuclei vary in number from 10 to 100, averaging between 30 and 50 The stromal cells are used by some for grading these tumors, but others have found little correlation between the clinical behavior and microscopic appearance Those usually appearing microscopically as the least malignant have stromal cells which are spindle-shaped few to no mitotic figures, and absence of vein invasion The more malignant tumors have much plumper stromal cells, many of which are round, and numerous mitotic figures are present The giant cells do not differ in appearance from one type to another

Clinical Characteristics

Although the giant-cell tumor is usually a large growth when first observed, its original location is almost always central and usually is in the long or tubular bones In the mandible there is swelling at the chin or over the coronoid process while in the maxilla tumefaction in the base of the nose or widening of the bridge of the nose with displacement of the eye is a common deformity

Pain is usually the first symptom At first it is mild intermittent and aggravated by physical activity, but later it is persistent, with local tenderness





FIG 15 1 (*Upper*)—Osteosarcoma producing a large ulcerated tumor mass with lingual displacement of the molar teeth The intradental papillae between the lateral, cuspid, and bicuspid teeth are all markedly hyperplastic, and the more anterior areas proved to be hypertrophic gingivitis rather than an ex tension of the tumor process

FIG 15 2 (*Lower*)—Fibrosarcoma arising in the periosteum of alveolar bone, producing a bulky ulcerating mass, and extension into the buccal tissues

per cent occur around the knee In the skull, the symphysis, the premolar area, and the coronoid process of the mandible, the canine fossa and ethmoid region in the maxilla, as well as the sphenoid bone, are sites of predilection.

The neoplastic process causes an erosion and expansion of the cortex The periosteum is usually not destroyed but remains as a limiting membrane The joint cartilage is likewise a natural barrier There is no bone formation within the tumor area, but at the periphery periosteal new bone does occur In the lower jaw these tumors are locally destructive, and when appearing in the maxilla and adjacent structures, they often invade the sinuses, nares, and orbit The gross appearance is that of a neoplastic expansile lesion fairly well demarcated from adjacent structures Sections made by cutting vary in their appearance according to the secondary changes, although, characteristically, fibrosis, hemorrhage, and cyst formation are visible The color is not always uniform, more typically it is a red-brown with an occasional area of gray or yellow-brown Where the tumor is more cellular, degeneration or necrosis is more common and the color is more variegated

Microscopic confirmation depends on finding a large number of giant cells in a spindle-cell stroma, the latter, however, is the important factor in evaluating the degree of malignancy The giant cells contain nuclei similar to those found in the stromal cells, and, if searched for, usually the latter can be seen entering into the tumor giant cells They are thought to be osteoclasts. The nuclei vary in number from 10 to 100, averaging between 30 and 50 The stromal cells are used by some for grading these tumors, but others have found little correlation between the clinical behavior and microscopic appearance Those usually appearing microscopically as the least malignant have stromal cells which are spindle-shaped, few to no mitotic figures, and absence of vein invasion The more malignant tumors have much plumper stromal cells, many of which are round, and numerous mitotic figures are present The giant cells do not differ in appearance from one type to another

Clinical Characteristics

Although the giant-cell tumor is usually a large growth when first observed, its original location is almost always central and usually is in the long or tubular bones In the mandible there is swelling at the chin or over the coronoid process, while in the maxilla tumefaction in the base of the nose or widening of the bridge of the nose with displacement of the eye is a common deformity

Pain is usually the first symptom At first it is mild, intermittent, and aggravated by physical activity, but later it is persistent, with local tenderness

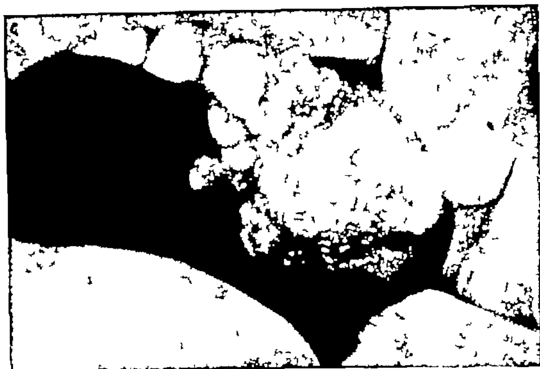




FIG 15 1 (*Upper*)—Osteosarcoma producing a large ulcerated tumor mass with lingual displacement of the molar teeth. The intradental papillae between the lateral, cuspid, and bicuspid teeth are all markedly hyperplastic, and the more anterior areas proved to be hypertrophic gingivitis rather than an extension of the tumor process.

FIG 15 2 (*Lower*)—Fibrosarcoma arising in the periosteum of alveolar bone producing a bulky ulcerating mass and extension into the buccal tissues.

The alveolar bone is invaded early, causing expansion, spacing, and malalignment of the teeth, which later become loose If on extraction of a tooth, tissue clings to the root or is seen in the alveolus, it should be submitted for microscopic examination

In the neglected case, the expansile growth process causes a complete destruction of cortical bone, leaving a periosteal covering which, on light palpation, feels like an eggshell cracking Ultimately there may be complication by pathologic fracture



FIG 15 3—Osteosarcoma with a minimal ill-defined osteoblastic and osteolytic process at the crest of the alveolar ridge in the molar area

Roentgenographic Appearance

The true giant-cell tumor involves certain specific areas, but otherwise there are no uniform roentgenographic characteristics In the mandible a well-demarcated, irregular, radiolucent area, lobulated and coarsely trabeculated, is seen At the onset there is a simple round or oval zone of radiolucency without sclerosis of the contiguous bone Later, the cortex gradually disappears, and the tumor outline may be lost With slow growth of the tumor, irregular destruction of the cortex may result in the so-called soap-bubble effect, which is by no means characteristic The cortex gradually becomes expanded and thinned until only a residual eggshell remains The periosteum remains intact in the less aggressive tumors, and it is rare for periosteal new bone to be seen even if a pathologic fracture occurs



Fig 15 4—Osteosarcoma with an extensive osteolytic destruction of medullary and cortical bone The margins are characteristically ill defined and blend into the surrounding normal bone.



FIG 15 5—Osteosarcoma arising in alveolar bone, extending from the lateral to the second bicuspid area, with typical osteolytic features and with destruction of periapical lamina dura This roentgenographic pattern can be deceiving It is also suggestive of osteomyelitis



FIG 15 6—Osteosarcoma with replacement of entire width of bone, with little change in the contour, but with extensive periosteal reaction and soft-tissue invasion



FIG 15 7 (*Upper*)—Osteosarcoma with prominent osteoblastic features involving the angle, ramus, coronoid, and condyloid processes

FIG 15 8 (*Lower*)—Same case as in Fig. 15 7 showing a hornlike projection of the osteoblastic process laterally from the angle of the jaw and the persistence of the normal marking of the inferior border of the mandible



FIG 15 5—Osteosarcoma arising in alveolar bone, extending from the lateral to the second bicuspid area, with typical osteolytic features and with destruction of periapical lamina dura This roentgenographic pattern can be deceiving It is also suggestive of osteomyelitis



FIG 15 6—Osteosarcoma with replacement of entire width of bone, with little change in the contour, but with extensive periosteal reaction and soft-tissue invasion



FIG 15 7 (*Upper*)—Osteosarcoma with prominent osteoblastic features involving the angle, ramus, coronoid, and condyloid processes.

FIG 15 8 (*Lower*)—Same case as in Fig 15 7 showing a hornlike projection of the osteoblastic process laterally from the angle of the jaw and the persistence of the normal marking of the inferior border of the mandible.



FIG 15 9—Osteosarcoma involving the entire body and alveolar process, with expansion below the still-visible lower border of the mandible The sunray effect visible here is not always typical

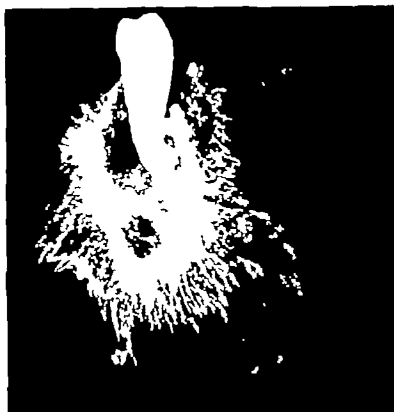


Fig 15 10—Same case as in Fig. 15 9 with the marked destruction of medullary and cortical bone Extensive soft tissue infiltration with the sunray effect beyond the still-visible cortical plates is seen.



Fig. 15 11—Chondrosarcoma producing an extensive ulceration and destruction of the alveolar process and with invasion and expansion of the remainder of the maxilla



FIG 15 12—Osteosarcoma producing a large expansion of the alveolus without ulceration Growth has progressed uniformly in all directions, causing a separation between the bicuspid and molar teeth and occlusal interference On palpation this mass was found to be bony hard over its entire surface

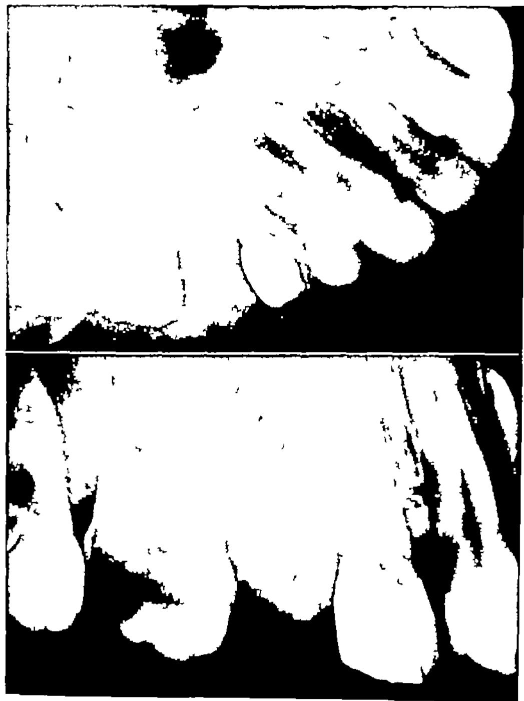


FIG 15 13 (*Upper*)—Same case as in Fig 15 12, showing a uniform, ground glass appearance simulating fibrous dysplasia.

FIG 15 14 (*Lower*)—Same case as in Figs. 15 12 and 15 13 showing in greater detail the mottled areas of greater densities, which helped to distinguish it from fibrous dysplasia.



FIG 15 15—Same case as in Figs 15 12, 15 13, and 15 14, with prostheses in place after hemiresection of the maxilla beyond the midline

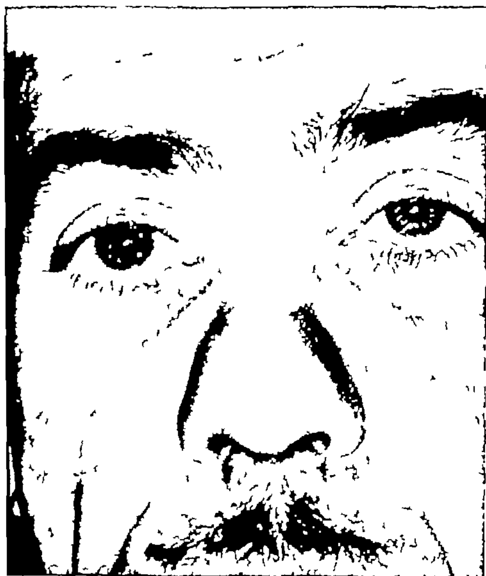


FIG 15 16—Fibrosarcoma of the left maxilla showing upward displacement of the eye as a result of invasion of the floor of the orbit.



FIG 15 17—Same case as in Fig 15 16, showing the operative site, the reflection of the lip and cheek, and the surgical defect

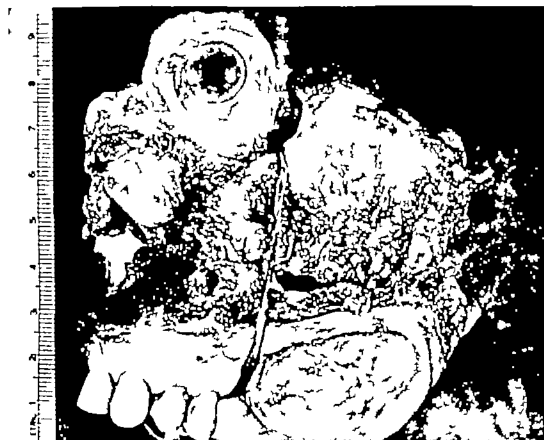


FIG. 15 18—The en bloc surgical specimen from case shown in Figs 15 16 and 15 17 showing the tumor in the molar area with gross involvement of the maxillary and orbital tissues



FIG 15 19—Same case as in Figs 15 16, 15 17, and 15 18, with the temporary moulage of dental compound in place

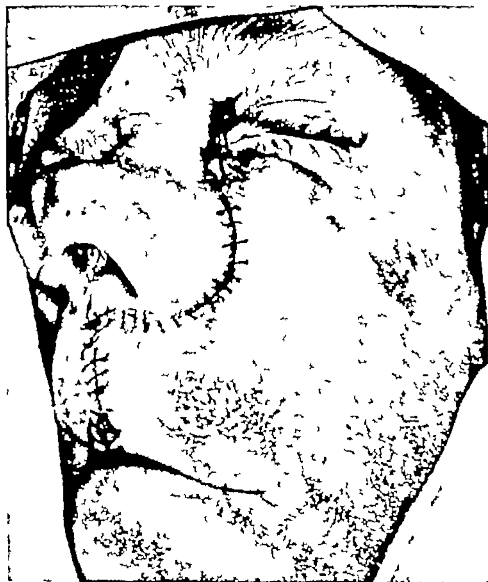


FIG. 15 20—Same case as in Figs 15 16 15 17 15 18 and 15 19 following closure of primary incision of the cheek and lip

The teeth may be displaced, and those in the area often show apical resorption with a destruction of the lamina dura

Diagnosis

The clinicoroentgenographic findings are not conclusive, and a final diagnosis can be made only by biopsy

Ameloblastoma simulates this tumor more closely than any other

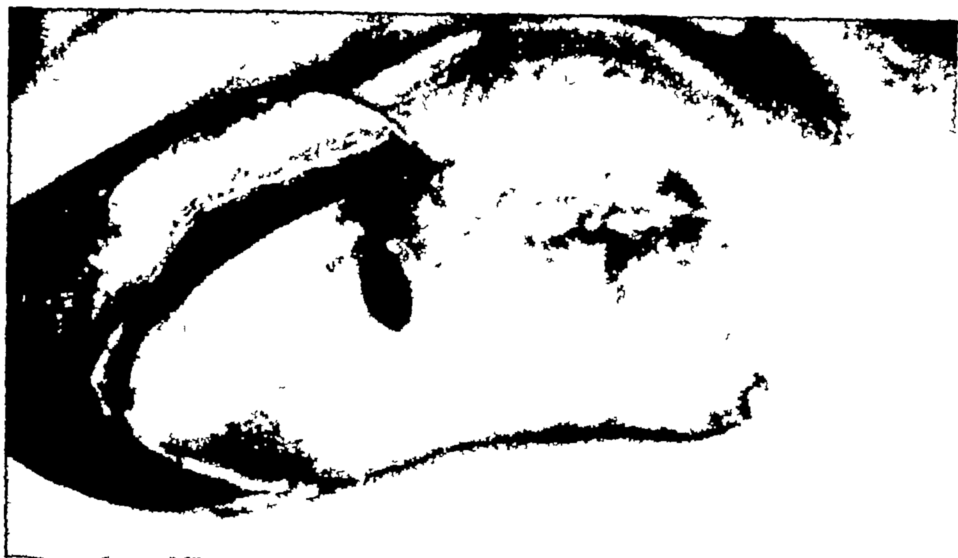


FIG 15 21—Fibrosarcoma of the maxilla nine years postoperatively The growth originally involved the bicuspid and first molar areas with extensive invasion of the alveolar and cortical bone A resection was performed at the level of the infraorbital foramen, although a part of the tuberosity was retained A partial denture without an obturator covered the surgical defect The surgical defect gradually closed to its present size

although peripheral or central giant-cell reparative granuloma and fibrous dysplasia should be considered in the differential diagnosis.

Treatment

There are still divergent views about the most successful therapy for such tumors There are proponents for radiation as well as for surgery. The so-called benign giant-cell tumor, if readily accessible, may be treated by thorough curetment, with or without replacement by bone chips However, these tumors are quite radiosensitive, and after a histologic diagnosis they may be advantageously treated with roentgen rays The aggressive giant-cell tumor, as well as those with definite sarcomatous change, is invariably treated by radical resection, whenever this form of surgery is possible Recurrences after either form of therapy suggest a more aggressive tumor, and radical surgery is then indicated whenever possible

READING REFERENCES

COLEY B L. *Neoplasms of Bone* Paul B Hoeber Inc. New York, 1953

JAFFE, H L "Giant cell tumor (osteoclastoma) of bone its pathologic delimitation and the inherent clinical implications," *Ann Roy Coll Surgeons England* 13:343–355 (1953)

JAFFE, H L L LICHENSTEIN and R B PORTIS "Giant cell tumor of bone its pathologic appearance grading supposed variants, and treatment," *Arch Pathol* 30:993–1031 (1940)

MACDONALD I and J W BUDD "Osteogenic sarcoma roentgenographic interpretation of growth patterns in bone sarcoma," *Surg Gynecol Obstet* 82:81–86 (1946)

PAUL, J K "Chondromyxosarcoma of the mandible" *J Oral Surg* 9 319–328 (1951)

SHARP G S "The diagnosis and treatment of osteogenic sarcoma of the jaws," *Western J Surg Obstet Gynecol* 41:399–406 (1933)

CHAPTER 16

Neoplasms of Reticuloendothelial Tissues

THE MYELOMAS

The myelomas are rare diseases of bone and soft tissue They may be either multiple or solitary When the jaws are affected, the multiple process is usually limited to bone, while the solitary form may start as a soft-tissue tumor and, if arising in bone, may become so large as to involve extraskeletal tissue The multiple form is a fatal disease which usually produces extensive involvement of the entire skeleton, and when seen in the jaw, it is always a manifestation of generalized disease

MULTIPLE MYELOMA

Incidence

Multiple myeloma represents approximately 10 per cent of all primary malignant bone tumors It is rare in persons under thirty and over sixty years of age, the onset of the disease usually occurs after forty Males are affected more frequently than females, in a ratio of about 3 1

Etiology

The origin of this disease is still not understood It is not certain whether it is a disease of the hematopoietic system with multiple foci of origin or whether it is a tumor arising as a single focus, with subsequent metastasis

Pathology

Multiple myeloma may be found in any bone in the skeleton but is most commonly found in the vertebra, sternum, rib, pelvis, cranium, or mandible

On gross examination the tumor tissue is soft and gray-red to red, depending on the amount of necrosis and hemorrhage The bones have ex

tensive lytic foci many of which have paper thin cortices with some pathologic fractures Associated lesions other than fractures are common having extraosseous deposits in lymph nodes spleen, and liver Such lesions are rarely observed in other tissues The so-called myeloma kidney is due to the precipitation of Bence Jones protein in the tubular lumina. Atypical amyloid may be deposited in the soft tissues and also in areas adjacent to the myeloma tissue in the bone Myeloma-cell leukemia may complicate the disease The microscopic findings in the tissues disclose myeloma cells which have some of the characteristics of the plasma cells of inflammation A further support of the view that the cell type is not a plasma cell is the myeloma cell s staining reaction to methyl green pyronine. This is as closely duplicated by embryonic osteoblasts as by nonneoplastic plasma cells Usually there are large foci of characteristic myeloma cells with little intercelluar material From case to case there is quite a marked variability in size and definiteness of the cell but in the individual case the uniformity is usually quite good. Two types of cells are seen the small cell type with superficial resemblance to the plasma cell and the large cell type generally exceeding the myeloblast in size. The latter cell type may have little resemblance to the plasma cell, and the nucleus is often centrally placed.

The diagnostic clinical laboratory findings are related to findings of abnormal cells in the marrow aspiration and of abnormal protein fractions in the serum and urine

Hypercalcemia develops in about 50 per cent of the patients This is because of a lytic effect of the tumor on the bone and because of the hyperglobulinemia

Hyperproteinemia is due to an increase in globulin of an abnormal type which frequently can be diagnosed categorically on electrophoretic studies This myeloma protein will vary in electrophoretic mobility from patient to patient and is characteristically seen as a high sharp spike often in the area of the normal gamma globulin fraction. It is also quite commonly seen in varying positions away from this area The use of paper electrophoresis in these studies gives greater precision in categorizing the myeloma protein The electrophoretic pattern of urine proteins is equally important in diagnosis These findings are not present in solitary myeloma.

Bence Jones proteinuria is present in approximately 60 per cent of patients with multiple myeloma. When present in association with the typical clinical findings it is diagnostic

Hyperuricemia is often present and is thought to be due to the release of nucleoproteins from myeloma cells

An anemia (normocytic) is frequently encountered and is due to bone

marrow replacement. Early, it is mild, but it becomes progressively more severe.

Marrow particle and smears aspirated from the sternum or crest of the ilium usually reveal the diagnostic myeloma cells

Peripheral blood smears may or may not reveal a few myeloma cells, but this procedure is necessary for the diagnosis of myeloma-cell leukemia, which is a rare development.

Clinical Characteristics

Many bones are actually involved at the time of the first examination, although the patient has complaints referable to only one or two specific areas Involvement of the spine is more often the cause for the initial symptoms. The disease is most often seen first in the spine and, in order of frequency, in the lumbar, dorsal, and the cervical vertebrae

The chief complaints are (1) pain, at first a vague aching or arthritic type of pain in the back which is often relieved by lying down, later, the pain is quite continuous, (2) weight loss, (3) weakness; (4) pathologic fracture, (5) a palpable tumor, which may be the first symptom noted by the patient, (6) neurologic manifestations, (7) uremia

The jaw is rarely the location for the initial complaint, although roentgenograms reveal jaw involvement in as high as 30 per cent of the myeloma cases The mandible is more frequently affected than the maxilla, and in most of the cases where there is maxillary involvement the mandible also has demonstrable disease The more common sites are the body and the ascending ramus of the mandible

Commonly presenting symptoms are pain, sensation of pressure, numbness, loosening of the teeth, and, rarely, swelling and expansion of the jaw

Roentgenographic Appearance

A rounded, punched-out radiolucent area, varying in size and without marginal sclerosis, is typical of multiple myeloma. Trabeculae are absent within the lesion In the ribs, because of the destruction of the cortex, the lesion may appear as a ballooning out Pathologic fractures are common In the vertebrae, collapse results in condensation of bone, which gives the false impression of increased density In the long bones, the deossification appears as a diffuse mottling or local cystlike area of destruction In the mandible, as elsewhere, the lesions commonly present as a diffuse mottling or as sharply demarcated, multiple, radiolucent, rounded lesions, varying in size The larger lesions have a cystic loculated appearance, with the margins less defined and hazy Frequently they appear as typical multiple, pea- or almond-sized radiolucencies that expand and may even fuse to form larger defects The

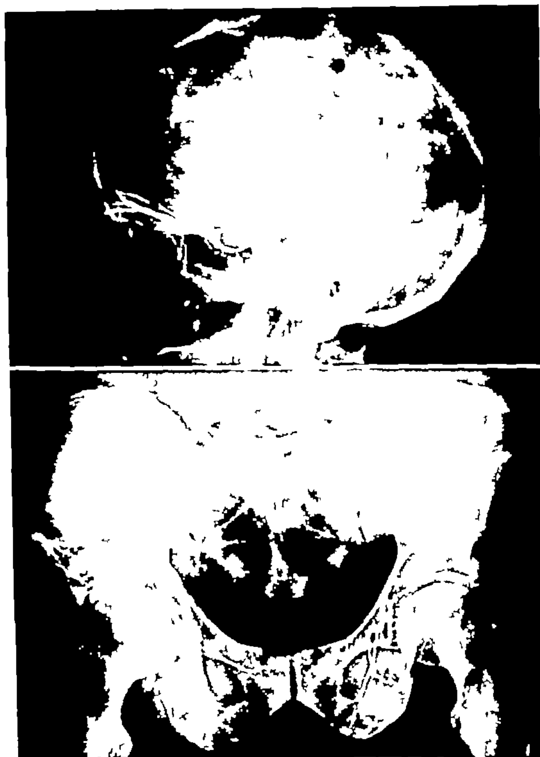


FIG 16 1 (*Upper*)—Multiple myeloma with diffuse osteolytic defects varying from small, punched-out radiolucencies to irregularly shaped, large well-outlined defects. The cortical destruction is well demonstrated in the superior portion of the calvarium.

FIG 16 2 (*Lower*)—Same case as in Fig 16 1 with a large, multiloculated, radiolucent defect in the ilium, as well as extensive destruction of the contralateral ischium

lamina dura may be destroyed in the involved areas, and frequently a resorption of the roots is seen If the maxilla is involved, the antrum is generally invaded, giving an appearance similar to that of other malignant tumors in this region

The roentgenographic diagnosis is usually not difficult Hyperpara-



FIG 16 3—Same case as in Figs 16 1 and 16 2, with small, diffuse, rounded osteolytic defects in the mandible Individual lesions are quite uniform in size but in some areas are superimposed or fused to produce large irregular radiolucencies

thyroidism and general metastases from carcinoma of the kidney or thyroid may mimic multiple myeloma, except that they have less uniformity of lytic defects and the lesions are fewer in number Senile osteoporosis may be indistinguishable from the early stages, and corroborating laboratory findings are required to confirm the diagnosis

Diagnosis

The diagnosis of multiple myeloma in the majority of patients requires a summation of the clinical, roentgenographic, hematologic, and biochemical findings

In the differential diagnosis of multiple myeloma, other diseases which cause a plasmacytic response in the bone marrow must be carefully considered chronic infection, granulomatous lesions in the bone marrow carcinomatoses, cirrhosis Hodgkin s disease, hypersensitive states and numerous other conditions These plasmacytic responses can be differentiated from myeloma by the over all clinical evaluation cytological study of the plasma cells present, and study of the electrophoretic pattern



FIG 16 4—Multiple myeloma showing in detail small, medium and large radiolucencies and the loculations within the large defect suggesting the fusion of smaller ones The margins in the smaller lesions are more regular when compared with the larger area, and none show evidence of sclerosis

Treatment

Treatment is not specific nor is it lasting, and the palliative therapy should be directed toward the relief of symptoms and protection against pathologic fractures. Although chemical agents are used to retard the progress of the disease roentgen therapy in small doses applied to painful areas particularly to the vertebrae ribs femur and mandible, control pain and possibly prevent pathologic fractures The radiation therapy should be held to a minimum since it adds further to anemia. Transfusions for the anemia urethan and stilbamidine are palliative agents but must be given with caution.

Prognosis

Multiple myeloma usually has a natural course of several years but is uniformly fatal. The various therapeutic agents must be applied with full appreciation of this fact, since drug therapy may prematurely shorten life because of its effect on the blood and because of renal failure.

SOLITARY MYELOMA

The solitary myeloma may involve a single bone or a focus in soft tissue before the multiple lesions develop. However, there is a small group of patients who remain alive and well for many years without developing evidence of the multiple form of the disease. It is, therefore, considered by some that there are two types of solitary myeloma: (1) a true myeloma which in the course of time will develop into the multiple form, (2) the type which cytologically resembles the true neoplasm, a benign solitary myeloma (so-called). Similarly the latter resembles the histiocytoses more than the myelomas.

Incidence

Solitary myeloma of bone is infrequent, and it is rare in the maxilla and mandible, while the soft-tissue type is more common in this region. The average age of patient on occurrence and the sex distribution are the same as for the multiple form.

Pathology

Solitary myeloma may be found in any bone or soft tissue but is more commonly found in the vertebra, femur, pelvis, antrum, and sphenoid sinuses. It rarely involves the nasopharynx, soft palate, tonsil, mandible or lung. On gross examination the tissue is found to be similar to that seen in the multiple form of the disease. In the soft-tissue type the tumor may be either pedunculated or sessile, is usually nonulcerated, has a smooth surface, is soft, and occasionally is quite friable. When arising in bone there is marked expansion, with thin and eggshell-like cortices, or there is extension through the cortex into the soft-tissue structures. Certain solitary myelomas may metastasize into the lymph nodes, spleen and liver, but atypical amyloid deposit and the laboratory deviations noted in the multiple form do not occur while they remain solitary. At any time a solitary myeloma may become multiple.

Microscopically, the tissue discloses the same type of cytologic structure noted in multiple myeloma. The exception to this, however, is in the so-called benign solitary myeloma, thought to be a focal hyperplasia of

histiocytes induced possibly by an inflammatory process in which the cells have a cytoplasm that is quite abundant but variable and some times faintly reticulated other times an immature fetal fat appearance is observed, while in still others there is a dense compact cytoplasm such as that seen in plasma cells and macrophages Eosinophils however are absent. The fat stains are faintly positive.

Clinical Characteristics

The lesion although rare in the oral cavity may however be present as a smooth, nonulcerated round swelling in the gingivobuccal sulcus tongue or palate Occasionally a patient will notice the swelling, more commonly of the mandible than of the maxilla, with loosening of the teeth. A bulky ulcerating lesion rarely occurs, and its site of origin in bone or soft tissue is difficult to establish because of bone destruction

Roentgenographic Appearance

A roentgenographic skeletal survey is important to determine if the lesion is solitary or a focus of multiple myeloma. Solitary lesions appear as osteolytic defects beneath the tumor In the mandible it is usually a gingival lesion with evidence of extensive bone destruction and without adjacent bone reaction Maxillary lesions arise more commonly in the nasal cavity and nasopharynx where bone destruction near the lesion may be demonstrated roentgenographically

Diagnosis

The diagnosis is based on the clinical histologic biochemical, and roentgenographic findings The roentgenographically observed lesions to be differentiated are the dentigerous cyst, ameloblastoma giant-cell tumor central reparative giant-cell granuloma and all metastatic lesions. When a single focus of myeloma is reasonably established, a long period of observation following primary treatment is necessary in order to determine whether the multiple form will develop

Treatment

Thorough curettage or roentgen therapy or both are indicated depending on the location and consideration of functional results. More radical measures are not considered advisable.

Prognosis

The prognosis for the true solitary myeloma must be guarded because of its propensity to become multiple in form. With the so-called benign type the prognosis is usually favorable.

THE MALIGNANT LYMPHOMAS

The primary malignant diseases of lymphoid or reticuloendothelial origin are commonly referred to as the malignant lymphomas Since myeloma is usually thought of as a distinct entity, although most probably arising from the same tissue, it is considered separately for purposes of discussion The leukemias likewise are related cytologically, as well as in other ways, to the malignant lymphomas but are considered clinically distinct entities

Members of the malignant lymphoma group, in descending order of frequency, are Hodgkin's disease, lymphosarcoma, reticulum-cell sarcoma, and giant follicular lymphoma Reticulum-cell *sarcoma is the only* lymphoma affecting the jaws primarily, but lymphosarcoma and Hodgkin's disease may invade secondarily.

Incidence

Of the lymphomas, Hodgkin's disease comprises from 30 to 40 per cent, lymphosarcoma, 15 to 20 per cent, reticulum-cell sarcoma, 5 to 10 per cent, and the giant follicular type, 3 to 5 per cent They all show a predilection for males While the soft-tissue types of these lesions may occur at any age (with the exception of Hodgkin's disease), they appear most frequently in the sixth and seventh decades Hodgkin's disease is seen more often in the third and fourth decades, while primary reticulum-cell sarcoma is observed in an earlier age group with approximately one-half of the patients between the ages of ten and thirty years

Pathology

The basis for classification of these neoplasms is cytologic; the various tumors have close cytogenetic affinity and may contain mixed cell population Some believe there is only one malignant tumor of lymphoid tissue and that it can adopt a variable histologic picture, even in the same lymph node, and differ only in degree and type of differentiation This belief is given credence because many cases when studied may show several histologic patterns The so-called pure-type tumors are, numerically speaking, much less frequent than those showing numerous variations in histologic patterns Then, too, there is the problem that tumors may at first be typical of one type, such as Hodgkin's disease—and yet, a later biopsy or necropsy may reveal entirely different structural patterns A rigid classification is therefore impossible

The most common site of origin for the lymphomas is the cervical lymph nodes, other sites being mediastinal, abdominal, axillary, and inguinal nodes The disease probably initially involves but one lymph

node however any lymphoid tissue in the body may be the site of origin or become involved during the course of the disease The gross appearance of lymph nodes cannot be used to define the type of lymphoma. This can be done only on proper histologic study The lymph nodes are enlarged, discrete or matted together and when sectioned they show obvious departure from the normal lymph node architecture

The differences in the various forms of the disease are cytologic The lymphosarcomas are composed of either lymphocytes lymphoblasts or both. The giant follicular type characteristically has well-defined germinal centers which are increased in number as well as in size These centers in contrast to those seen in inflammatory processes, do not show phagocytosis. The sinusoids are obliterated by compression, because of the overgrowth of lymphocytes. In reticulum-cell sarcoma some cells are round, others are elongated, many are reniform, and some are bi nucleated The cytologic hallmark that distinguishes Hodgkin s disease from the others is the Reed Sternberg cell This may be a mononuclear multinuclear or multilobed cell thought to be derived from the re ticulum cell. They are usually randomly present in a polymorphic cellular background which includes lymphocytes eosinophils, neutrophils and fibroblasts. Necrosis and fibrosis are common. In the sarcomatous type of Hodgkin s disease the reticulum cells and Reed Sternberg cells pre dominate

In extraosseous tissues Hodgkin s sarcoma and reticulum-cell sarcoma are usually not considered separately however intraosseous lesions are more precisely defined. Grossly bones affected by reticulum-cell sarcoma cannot be distinguished from many of the other tumors affecting bone The tumor material is gray white and invariably altered by necrosis and hemorrhage Microscopically the normal architecture of the marrow is obliterated by sheets of large cells 10 to 20 μ in diameter and similar to those seen in soft tissue

Clinical Characteristics

The malignant lymphomas in general are primarily tumors of lymph structure All of these malignancies have systemic manifestations which are not relevant to the differential diagnosis among the lymphomas Reticulum-cell sarcoma is the only one of the lymphomas which may arise in bone, and none has yet been proved to originate in the jaws. Reticulum-cell sarcoma, lymphosarcoma, Hodgkin s disease, and the leukemias may metastasize or invade the jaws secondarily The present discussion will be restricted to reticulum-cell sarcoma.

The initial symptoms of reticulum-cell sarcoma are most often those produced by the primary growth, which, in the majority of cases is an enlarged lymph node in the neck. Other presenting symptoms in their

order of frequency, are pain, tiredness dyspnea, and cough The general condition of the patient usually remains good until the disease becomes generalized, and progression is the rule, with invasion of lymph nodes, liver, spleen, and bone marrow

Reticulum-cell sarcoma arises rarely in the gingiva, palate, or cheek but it is of soft-tissue origin, and bone is invaded only secondarily Ulceration appears quickly, and the growth progresses rapidly The bones of the jaws may be involved by extension from soft-tissue sites in the mouth, or by metastasis from either soft tissue or osseous foci This tendency to metastasize from one bone to another is shared with Ewing's sarcoma

Unless early therapy is successful in the complete eradication of the primary focus of disease, the clinical course is usually one of rapid dissemination

Roentgenographic Appearance

The roentgenograms of either primary or secondary osseous foci demonstrate a centrally placed destructive tumor, of both spongiosa and cortical bone, which produces a more or less fusiform enlargement In early cases destruction may be limited to the medullary cavity and cannot be detected roentgenographically, later, mottled areas of destruction may be observed which are associated with multiple small areas in the cortex Not only do these lesions have little or no new bone, but periosteal reactive bone formation is usually absent In the mandible the lesions first appear as punched-out radiolucent areas with fairly well-defined margins. In the maxilla the appearance is that of widespread destruction of bone associated with clinical extension into soft tissues

Diagnosis

Certain findings are helpful in tentatively establishing a diagnosis The occurrence in a patient over thirty-five years of age almost always excludes Ewing's sarcoma and fibrosarcoma Roentgenograms show a bone-destructive lesion simulating a root abscess, osteomyelitis, or carcinoma, and their diagnostic value lies in placing the process among those requiring differential diagnosis from the malignant destructive tumors of bone

The final diagnosis is made only by biopsy Frequently the precise category within the lymphoma group may remain indeterminate, since any of these diseases may undergo transition

Treatment

These tumors are moderately radiosensitive, and during a preliminary course of roentgen therapy it may be possible to determine whether the



FIG 16 5—Reticulum-cell sarcoma with large variously shaped but well-defined radiolucent defects throughout the body and ramus, as well as a superficial concave area of destruction in the molar region A large soft-tissue tumefaction was observed over the latter



FIG 16 6—Reticulum-cell sarcoma presenting as a large slightly indurated, and bifid swelling of the palate All alveolar and palatal bone was destroyed, and the nares and antra were obstructed with tumor tissue

disease is confined to its primary site. If metastases cannot be demonstrated during this interval, two courses of treatment are available: the continuation of roentgen therapy to a dose of 5000 tumor roentgens over three to four weeks, or a jaw resection. The surgical procedure is most frequently used for the reticulum-cell sarcoma arising in the palate, nasal cavities, or accessory sinuses.

The duration of the disease is variable—from a few months to years. The prognosis is much worse in the younger age group.

LEUKEMIA

Leukemia is a fatal malignant disease of the tissues which create white blood cells. Generally, but not always, the abnormal cells are found in peripheral blood in large numbers. Red bone marrow and later all marrow is variably replaced by this neoplastic tissue. The length of the clinical course varies greatly. If the disease is of short duration, it is termed *acute*; if it lasts for a number of years it is called *chronic*. On the basis of cytology, the various types of leukemia are commonly classified as lymphocytic, granulocytic, and monocytic. In many of the acute forms the cells are so immature that the cytologic type cannot be accurately determined.

Incidence

Although leukemia may occur at any age, the acute cases of all types are predominantly in children and young adults. The chronic cases are found among the middle or older age groups. Both sexes are affected, but the disease is more commonly observed in males.

Etiology

Although the actual cause remains unknown, the incidence has been shown to be increased in those who have had an excessive exposure to the various forms of radiation. Radiologists and survivors of the atom bomb explosions in Japan are examples of such persons.

Pathology

The bone marrow in leukemia is usually displaced by a tremendous overgrowth of white blood cells. Usually, though not always, there are large numbers of these abnormal white cells in the blood stream. The white cell count not infrequently is over 500 000 per cubic millimeter.

The other marrow elements are pushed aside to make room for this proliferative mass of cells, and the normally dormant yellow marrow is also taken over by the new growth. The distinction between the various

types of the leukemias is based on cytological differences These will now be discussed.

Lymphocytic Leukemia

ACUTE. Though the designations acute and chronic are temporal and clinical nevertheless it is generally found that the acute form will have very immature cells These usually are so undifferentiated as to make it impossible to tell with certainty whether they are lymphocytic or granulocytic in type. The leukemias of childhood are usually characterized by these immature cells.

CHRONIC. The type of cell seen in the lymphocytic leukemia with a prolonged course is a small mature lymphocyte. The patients are often in the older age group and the marrow picture is one of a slow over growth of mature lymphocytes

Granulocytic Leukemia

ACUTE. The distinction from other acute forms may be impossible therefore the discussion above also applies to this type. In some cases however there are findings in the cells that will place them in the granulocytic category

CHRONIC. This type often presents a classic leukemia picture, with a high white cell count in which the leukocytes are chiefly of the granulocytic series. All stages of maturity are seen ranging from the blast cells down through the various stages of polymorphonuclear leukocytes. Since this picture in the circulating blood is similar to that seen in the normal bone marrow it is often referred to as *myelogenous* or *myeloid leukemia*

Monocytic Leukemia

These forms are not always acute. A number of monocytic leukemias are apparently phases or variations of granulocytic leukemia, hence, differentiation may be difficult, or impossible In our experience, as well as that of others, leukemic infiltrates of the gingiva are especially common in this variety In all the acute leukemias, the number of platelets and red cells is markedly reduced. This accounts for the hemorrhagic tend encies as well as for the severe anemia

Clinical Characteristics

Acute Leukemia The onset of this disease is relatively rapid. Often there are constitutional symptoms such as fever fatigue, lassitude pete chiae, hemorrhages, and secondary infection. In children there may be pain and/or tenderness in the bones and joints Ulcerative lesions may be present in the oral mucosa, as well as general hypertrophy of the

gingivae, which may cover the teeth Because of the profound thrombocytopenia, free bleeding of the gums as well as generalized purpura, is commonly seen Periodontal infection and loosening of the teeth often occur

Chronic Leukemia The onset is usually insidious and it is difficult to establish exactly how long the disease may have been present before



FIG 16·7—Leukemic infiltrate appearing as soft-tissue, dome-shaped, partially ulcerated swellings on the hard palate The surface was irregularly nodular and on palpation was slightly less firm than the texture of a minor salivary gland or other benign tumors

the first symptoms occurred Later in the course of the disease, thrombocytopenia occurs and the general symptoms are similar to those described for acute leukemia

Roentgenographic Appearance

Acute Leukemia This disease, particularly the lymphocytic type, is responsible for the majority of roentgenographically demonstrable skeletal lesions This is particularly true in children between 50 and 60 per cent of whom will show skeletal involvement during the course of the disease The earliest signs noted are a transverse radiolucency at the ends of the shafts of long bones, with the resultant slowing down

of bone formation at these sites Such changes are not pathognomonic however but when associated with evidence of periosteal new bone deposition on the shafts of long bones the evidence is more suggestive Severe changes are usually generalized and reveal a diffuse osteoporosis with radiolucent areas extending along the medullary cavities. There is thinning of the cortex but with little or no expansion Small areas of



FIG. 16 8—Mylocytic leukemia arising within the body of the maxilla and presenting clinically as a fusiform bony hard swelling of the alveolus, without ulcerating Marked displacement of the teeth, as well as roentgenographic evidence of bone destruction, was demonstrated.

cortical rarefaction may be present, and the medullary cavities have a honeycomb trabeculation. In the skull the changes are concerned chiefly with the diploë, the outer aspect of the inner table and the inner aspect of the outer table where small osteoporotic changes are seen with an overlying periosteal elevation or thinning. This punctate radiolucent mottling is a leukemic replacement of the osseous structure In adults roentgenographically demonstrable changes in the skeleton are seen in about 8 to 10 per cent of patients. A mild, generalized porosity and small or large discrete or confluent rarefactions in the medullary cavity and cortex with an overlying periosteal new bone deposition are commonly seen The roentgenographic signs are mild compared with the extent of bone involvement

Roentgenographic findings are rarely recorded in the mandible. In facial bones, however a bone-destructive process is described which

gingivae, which may cover the teeth Because of the profound thrombocytopenia, free bleeding of the gums, as well as generalized purpura, is commonly seen Periodontal infection and loosening of the teeth often occur

Chronic Leukemia The onset is usually insidious, and it is difficult to establish exactly how long the disease may have been present before



FIG 16 7—Leukemic infiltrate appearing as soft-tissue, dome-shaped, partially ulcerated swellings on the hard palate The surface was irregularly nodular and on palpation was slightly less firm than the texture of a minor salivary gland or other benign tumors

the first symptoms occurred Later in the course of the disease, thrombocytopenia occurs, and the general symptoms are similar to those described for acute leukemia

Roentgenographic Appearance

Acute Leukemia This disease, particularly the lymphocytic type, is responsible for the majority of roentgenographically demonstrable skeletal lesions This is particularly true in children, between 50 and 60 per cent of whom will show skeletal involvement during the course of the disease The earliest signs noted are a transverse radiolucency at the ends of the shafts of long bones, with the resultant slowing down

of bone formation at these sites Such changes are not pathognomonic however but when associated with evidence of periosteal new bone deposition on the shafts of long bones the evidence is more suggestive. Severe changes are usually generalized and reveal a diffuse osteoporosis with radiolucent areas extending along the medullary cavities. There is thinning of the cortex but with little or no expansion Small areas of



FIG 16 8—Myelocytic leukemia arising within the body of the maxilla and presenting clinically as a fusiform bony hard swelling of the alveolus, without ulcerating Marked displacement of the teeth as well as roentgenographic evidence of bone destruction, was demonstrated

cortical rarefaction may be present, and the medullary cavities have a honeycomb trabeculation. In the skull the changes are concerned chiefly with the diploë the outer aspect of the inner table and the inner aspect of the outer table where small osteoporotic changes are seen with an overlying periosteal elevation or thinning This punctate radiolucent mottling is a leukemic replacement of the osseous structure. In adults roentgenographically demonstrable changes in the skeleton are seen in about 8 to 10 per cent of patients A mild, generalized porosity and small or large, discrete or confluent rarefactions in the medullary cavity and cortex with an overlying periosteal new bone deposition are commonly seen. The roentgenographic signs are mild compared with the extent of bone involvement.

Roentgenographic findings are rarely recorded in the mandible. In facial bones, however a bone-destructive process is described which

may obliterate one or more of the sinuses, and not infrequently orbital involvement is observed, particularly in children

Chronic Leukemia Skeletal involvement is rarely evident. It is chiefly during the periods of exacerbations that alterations in osseous tissue are demonstrable During remissions these signs may become less evident The roentgenographic appearance is similar to that for acute leukemia

Diagnosis

The diagnosis of leukemia is usually not difficult In contradistinction to most other malignant diseases, the leukemias are studied cytologically Stained smears of the blood or bone marrow are used In the chronic type however, the systemic symptoms usually precede osseous involvement by several months or by as much as four or five years In acute leukemias on the other hand, the roentgenographic changes in the bones may suggest the correct diagnosis, particularly if there is a leukopenia At least such demonstrable skeletal lesions may lead to bone marrow study which will disclose the presence of leukemia

Differentiation between the leukocytosis due to inflammatory processes and other diseases which may simulate leukemia is usually readily made by adequate hematologic studies

Treatment

Leukemia is usually a fatal disease Therapy seeks for palliation or remission In the chronic type the approach is usually made through chemotherapy or radiation Radiation may be administered in either roentgen-ray or radioisotopic form A number of chemotherapeutic agents, including the hormones, have definite value

In the acute form, radiation is generally contraindicated and therapy, aside from supportive measures (blood transfusions, use of antibiotics, etc.), is limited to administration of hormones and some of the chemotherapeutic agents These latter have most value in producing remissions of the leukemias of childhood

Prognosis

The prognosis for patients with acute leukemia is indeed grave Ten weeks to a year is the average survival period In chronic leukemia, a three- to five-year survival is the usual life expectancy.

EWING'S SARCOMA

This is a primary malignant neoplasm of bone that was first classified as a round-cell sarcoma Ewing correlated the clinical roentgenologic pathologic, and therapeutic findings and proposed the name of *endo*

thelial myeloma but because of lack of agreement on histogenesis this entity is most often referred to as *Ewing's sarcoma*

Incidence

Ewing's sarcoma comprises approximately 12 per cent of all primary malignant bone tumors in the jaws, although it is rarely observed initially in this location. Males are affected twice as frequently as females It appears more commonly in children and young adults and rarely occurs after the age of thirty five.

Pathogenesis

Ewing originally described this neoplasm as being derived from angio-endothelium in the bone marrow This concept of histogenesis has been questioned and some hold that it is derived from the reticular tissue of bone marrow but there is no general agreement.

Pathology

Ewing's sarcoma may arise in any bone of the skeleton The approximate order of frequency is the pelvis tibia, jaw humerus fibula, scapula, and ribs. Although unicentric in origin these tumors quickly metastasize to other bones and to the lungs The tumor arises centrally penetrates and partially destroys the cortex, and elevates the periosteum Thickening of the cortex is due to periosteal reactive bone formation, which may be either in parallel or in perpendicular alignment. On cross section the bone is seen to be porous, and the tumor is red soft and jellylike

On microscopic examination the tumor is made up of sheets of round or oval cells with abundant partitions of well vascularized connective tissue. The cells have scant cytoplasm, and the nucleus is vesicular The chromatin is fine and evenly distributed. Nucleoli are difficult to discern and, when seen are minute Giant and multinucleated cells are not present. The cells are monotonously the same, except for variation in mitotic figures They are smaller than the so-called type of cell of reticulum-cell sarcoma and do not form reticulum neither do they form bone but reactive bone may be seen throughout the tumor

The microscopic diagnosis is often most difficult. The tumor is highly radiosensitive, and the common practice of administering a diagnostic test dose of roentgen rays prior to biopsy invariably causes such marked changes in the tumor tissue that it is impossible to recognize the cell structure.

Clinical Characteristics

The history of onset is generally one of pain, swelling and disability in the affected part. Pain may be gradual or of sudden onset. Swelling

with increased local heat and cutaneous erythema, is a frequent early sign. This onset may, with its elevation of body temperature and of white blood cell count, simulate an acute osteomyelitis Disability is not always present but is a presenting symptom in some cases Early signs and symptoms of these tumors occurring in the jaws are similar to those elsewhere in the skeleton Facial pain is intermittent at the onset but increases with local tenderness Paresthesia of the lips is common, and the extraosseous extension of the tumor may become large and out of proportion to the roentgenographic evidence of bone involvement The teeth are not affected early and remain in alignment until the destruction of bone has become advanced

Roentgenographic Appearance

The usually described roentgenographic features of Ewing's sarcoma are not pathognomonic, since this tumor can actually simulate any lesion in the skeleton—from osteomyelitis to osteogenic sarcoma Certain basic changes may be seen, singly or in combination, to cause such varied bony patterns as an expansion and increased density of the cortex, a mottled lysis, a cystic loculation, or a varying degree of periosteal reaction overlying the lesion

The appearance of Ewing's sarcoma in the jaw is equally difficult to interpret Minimal changes may usually be seen as a mottling of the bone or as an increased density of the cortex Approximately half the cases will show a periosteal reaction which may be represented by a single small layer close and parallel to the bone, or more rarely by the so-called onion-peel or sunray effects These latter are infrequent findings in this tumor and are also present in other lesions of bone

Osteomyelitis or osteoporosis may be confused with this tumor, but the diffuse mottling of the cortex simulating wormwood, together with the periosteal response, is observed in Ewing's sarcoma Osteosarcoma may be difficult to differentiate from Ewing's tumor, but it usually infiltrates directly through the cortex without expanding it, and frequently the contour of the old bone remains visible within the tumor

The roentgenographic examination should include intraoral as well as extraoral films taken from various angles to detect all features of the tumor as well as its relationship to the teeth Roentgenograms should include also the chest, and any bone with pain, for the presence or absence of metastasis.

Diagnosis

The diagnosis of a classic case of Ewing's sarcoma can be tentatively made on the clinical and roentgenographic findings The majority of the cases are less typical, and a careful survey of the clinical history and

roentgenographic and laboratory findings is necessary to differentiate it from osteogenic sarcoma osteomyelitis sclerosing osteomyelitis of Garré, tuberculosis and suppurative and syphilitic osteoperiostitis There fore a prompt biopsy is absolutely necessary for a conclusive diagnosis A diagnostic test dose of roentgen rays or a trial course of antibiotics should not be used as diagnostic measures for they only delay a definite diagnosis and early treatment

Metastatic neuroblastoma in infants and children may be indistinguishable from Ewing s sarcoma. Multiple myeloma, reticulum-cell sarcoma, and metastasis from anaplastic carcinoma simulate certain features of Ewing s sarcoma but are more commonly found in the older age group

Treatment

Ewing s sarcoma is a notoriously highly malignant tumor The treat ment for the tumor clinically confined to a single site may be one of three procedures (1) amputation or resection, (2) amputation or resec tion with irradiation (3) irradiation alone

The majority of the authentic arrested cases have been treated pri marily by amputation or resection Certain of these patients were treated with radiation preoperatively and others postoperatively Ewing s sar coma of the jaw is not different from that of any other part of the skeleton If metastases are not evident after careful search, a resection should be performed Preoperative roentgen therapy is not advised, since effective doses are not tolerated by the jaws On the other hand postoperative therapy is justified for all cases

The five year survival is estimated to be about 4 per cent.

READING REFERENCES

BERNIER, J L. "Differential diagnosis of oral lesions II Malignancies of the oral regions" *Oral Surg Oral Med Oral Pathol* 2:690–703 (1949)

BRUCE, K W., and R Q ROYER "Multiple myeloma occurring in the jaws" *Oral Surg Oral Med Oral Pathol* 6:729–744 (1953)

CALMAN H I "Lymphosarcoma of the maxilla," *Oral Surg Oral Med Oral Pathol* 6:232–236 (1953)

CHRISTOPHERSON W M., and A. J MILLER "A re-evaluation of solitary plasma cell myeloma of bone," *Cancer* 3:240–252 (1950)

CLAUS, E C "Oral manifestations in a case of myelogenous leukemia and leukopenia," *Oral Surg Oral Med Oral Pathol* 7:616–619 (1954)

COLEY B L. N L. HIGINBOTHAM, and H P GROESBECK. "Primary reticulum cell sarcoma of bone Summary of 37 cases," *Radiology* 55:641–658 (1950)

CRAVER, L. F "Lymphomas and leukemias the value of early diagnosis and treatment," *J Am Med Assoc* 136:244 (1948)

CURTIS, A C M L FOLLO and H R RUTTAN "The clinical diagnosis of dermatological lesions of the face and oral cavity II," *Oral Surg Oral Med Oral Pathol* 3 750–783 (1950)

EWING, J *Neoplastic Diseases a Treatise on Tumors*, 4th ed W B Saunders Company, Philadelphia, 1940

EWING, M R, and F W FOOTE, JR "Plasma-cell tumors of the mouth and upper air passages," *Cancer* 5 499–513 (1952)

GUTMAN, A G "Plasma proteins in disease," *Advances in Protein Chem* 4.155–250 (1948)

JAFFE H L "Skeletal manifestations of leukemia and malignant lymphoma," *Bull Hosp Joint Diseases* 13·217–238 (1952)

JOHNSON, L C, and G E MEADOR "The nature of benign 'solitary myeloma' of bone," *Bull Hosp Joint Diseases* 12:298–313 (1951)

LICHTENSTEIN, L, and H L JAFFE "Multiple myeloma survey based on 35 cases, 18 of which came to autopsy," *Arch Pathol* 44 207–246 (1947)

PLATZER, R F "Treatment of multiple myeloma," *N Y State J Med.* 54. 103–110 (1954)

SILVERMAN, F N "The skeletal lesions in leukemia clinical and roentgenographic observations in 103 infants and children, with review of literature," *Am J Roentgenol Radium Therapy* 59 819–844 (1948)

SPITZER, R, and L W PRICE "Solitary myeloma of the mandible," *Brit Med J* 1 1027–1028 (1948)

THOMA, K H, D J HOLLAND JR, H W WOODBURY, J G BURROW, and E L SLEEPER "IV, Contribution to the oncology of the jaws," *Oral Surg Oral Med Oral Pathol* 1 40–66 (1948)

CHAPTER 17

Lesions of Vascular and Nerve Tissue

HEMANGIOMA

The hemangioma is an exceedingly rare lesion in the jaws, being more commonly observed in other parts of the skeleton particularly the vertebrae Although a benign tumor the hemangioma is more frequently seen to invade the jaws from adjacent tissues than to arise primarily in bone.

These tumors are usually first recognized in the third or fourth decades of life and affect males more frequently than females Approximately 10 per cent of the population have skeletal hemangiomas and at least two-thirds of these are located in the vertebrae

The etiology is unknown It is not definitely understood whether these lesions are neoplasms hamartia, or developmental defects

Hemangiomas of bone may be either cavernous or capillary On gross examination, the affected bone is usually seen to be replaced by large blood filled spaces, some of which contain a currant jelly like clot. The cortex is destroyed and expanded to a thin shell with evidence of subperiosteal compensatory new bone formation. Microscopic examination of the cavernous type reveals large blood vascular spaces with delicate fibrous tissue septa not unlike those seen in erectile tissue. Some of the spaces contain hyalinized and calcified bodies (phleboliths) Rarely the structure is that of small blood vessels resembling capillaries, although they are actually much larger and the walls much thicker In either type a capsule is not present and there is a variable amount of reactive bony trabeculae at the border as well as centrally where they appear as septa separating lobules of hemangiomatous tissue Sometimes the hemangioma becomes fatty to such an extent that it is mistaken for a lipoma.

These lesions are usually asymptomatic and follow a course similar to that of other central benign tumors The discovery of the lesion is usually made on routine roentgenographic examination, and multiplicity of osseous lesions is not uncommon

Roentgenographically these tumors are seen in the medullary or

cortical bone The cavernous type may produce a multicystic multilocular configuration with a sharply defined margin and an ex sion and thinning of the cortex to give a soap-bubble effect The c lary type produces a delicate inner trabecular framework, which m into the normal cancellous structure Often there is a marginal scle particularly in lesions of the skull Rarely infiltrative lytic defect seen in the cortex giving a sunburst appearance The lesion in mandible is seen as a central radiolucency usually without co changes

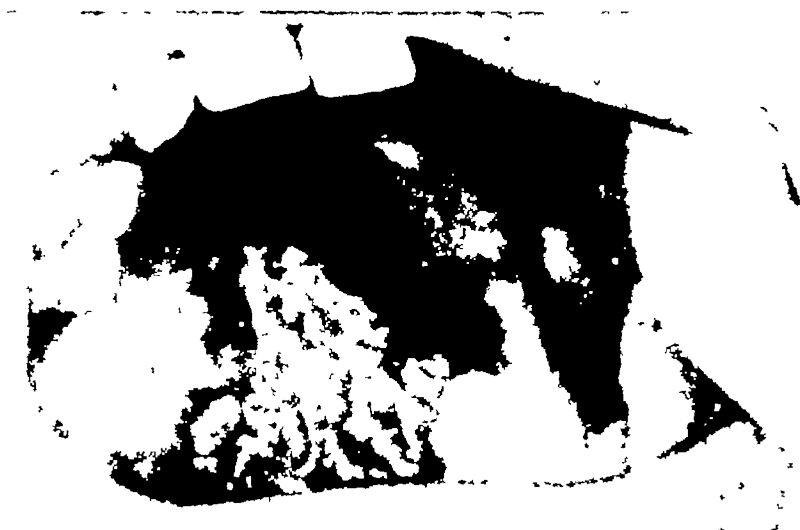


FIG 17 1—Cavernous hemangioma which has by direct extension destr alveolar, palatal, and maxillary bone and invaded peripheral soft tissues

The differential diagnosis must include all central radiolucent def A periodontal cyst is one of the more important of these defects P dontal cyst is suggested by absence of the periapical lamina dura a negative vitality test Other defects to be considered are the peripl giant-cell reparative granulomas, traumatic cysts and fibrous dyspla A surgical exploration and biopsy are indicated for a definitive diag for all central radiolucent lesions However, when one of these tu is exposed and its appearance is characteristic, a thorough curettag indicated Should this procedure appear unnecessarily destructive, ro gen therapy is effective in controlling the tumor and may be the tr ment of choice The prognosis is good with either method

HEMANGIOSARCOMA

These tumors are most common in the skin, mucous membrane, subcutaneous tissue They rarely occur in bone and have not b

observed in the jaws Hemangiosarcoma almost always arises *de novo* and seldom results from transformation of a hemangioma. The gross appearance is similar to that of the hemangioma while the microscopic features are characterized by an extreme cellularity with proliferation of endothelial cells to form both areas of solid tissue and vascular spaces The degree of malignancy is variable some grow slowly and metastasize late (Kaposi's disease) while others grow rapidly and metastasize early

The diagnosis must be established by microscopic examination. The treatment is resection or amputation as the case requires.

NEUROFIBROMA AND NEURILEMMOMA

Neurofibromas are benign tumors derived from the peripheral nerves and may be solitary multiple or plexiform. They may or may not be associated with neurofibromatosis of von Recklinghausen s type

Two types of neurogenic tumors occur in the jaws the neurofibroma and neurilemmoma. Both are derived from the sheath of Schwann cells The neurofibroma is benign and unencapsulated while the benign neurilemmoma is encapsulated. These tumors are relatively common and affect no special age group They are more common in the mandible than in the maxilla and most frequently are associated with third division of the trigeminal nerve Grossly the tumors are rounded or oval although they may assume unusual shapes because of varying tissue resistance in the jaws On cross section they are usually seen to be yellow pink, or gray and of firm consistency however some may show edematous cystic, or necrotic changes Both types are discrete, well-circumscribed nodules but the neurofibroma is not so well separated from its nerve of origin as is the neurilemmoma. The latter tends to displace nerve fibers peripherally while the neurites are an integral part of the neurofibroma.

Microscopically the neurofibromas have a more uniform structural characteristic than does the neurilemmoma and are composed of loosely arranged spindle cells which are separated by varying amounts of edema. There is no palisading of nuclei to the degree seen in the neurilemmoma. The microscopic picture of the neurilemmoma reveals solid areas with palisading of nuclei and other areas where the tissue is loose and edematous with microcysts The solid portions have twisted congeries of Schwann cells.

The clinical course in the majority of cases is asymptomatic from a few months to many years Growth is slow and pain or paresthesia is rarely an early symptom.

Roentgenographically these tumors in the mandible produce a circular or fusiform expansion in or near the mandibular canal which is clearly visible as a radiolucent area with a well-defined but nonsclerotic

margin. More rarely, the canal may appear irregularly expanded through part of or its entire course (plexiform type) Certain of these tumors are osteolytic in character and cause a destruction and expansion of the

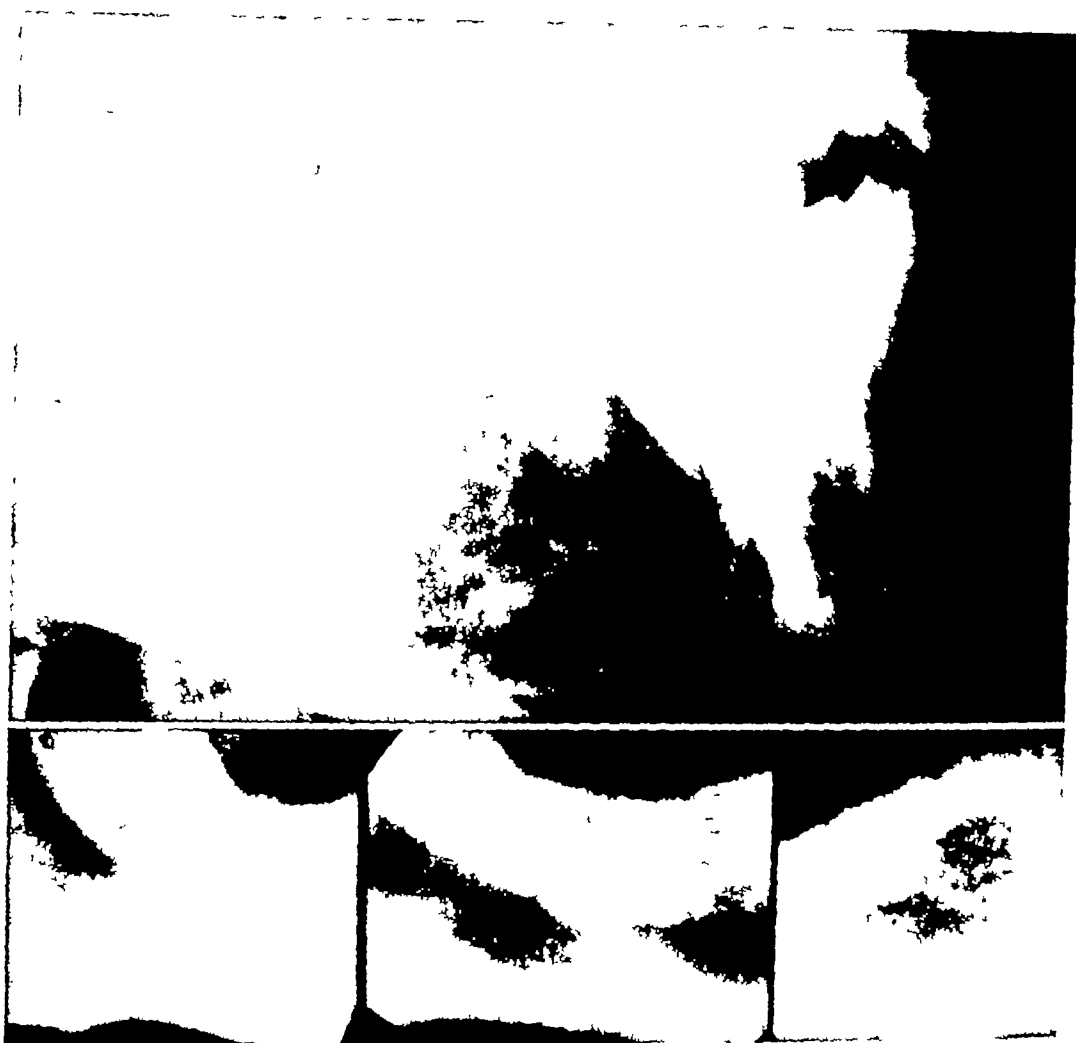


FIG 17·2 (*Upper*)—Neurofibroma causing a large radiolucent area between widely separated bicuspid teeth The appearance somewhat suggests either a primordial follicular or a periodontal cyst.

FIG 17 3 (*Lower*)—Neurofibroma involving the mandibular canal along its entire course from the mandibular to mental foramen

cortex to an eggshell thinness Occasionally, these are mistaken for periodontal cysts, although ordinarily the slight distention of the mandibular canal at the entrance or exit of the tumor is a distinctive feature

The treatment consists of an exploration for diagnosis and removal The discrete tumor is exposed with a linear incision, if the tumor separates readily, it is a neurilemmoma and sensory function is not impaired The more common neurofibroma presents greater surgical difficulty, for



FIG 17 4—Neurofibroma causing a radiolucent zone between the divergent bicuspid tooth roots The lacelike pattern produced by cortical bone suggests a destructive rather than an expansile process.

it does not separate from the nerve. It is usually possible to remove the discrete type from the nerve with only partial loss of sensory function The plexiform type is most serious since the removal of the mandibular portion of the nerve may not be sufficient to include the proximal ex tension of the process. Recurrence following removal of the discrete forms is rare while the prognosis of the plexiform type is guarded.

READING REFERENCES

BRUCE, K. W "Solitary neurofibroma (neurilemmoma, schwannoma) of the oral cavity" *Oral Surg Oral Med Oral Pathol* 7:1150–1159 (1954)

CORNELL, C. F., and H A. VARGAS "Intraosseous neurofibroma of the man dible," *Oral Surg Oral Med. Oral Pathol.* 8:34–39 (1955)

PIZER, M E. "Cavernous hemangioma occurring in the body of the mandi ble" *Oral Surg Oral Med Oral Pathol* 7:1201–1203 (1954)

CHAPTER 18

Metastatic Bone Tumors

The metastatic jaw tumor arises from a viable cancer cell embolus transported by way of the blood stream from a primary or secondary cancer elsewhere in the body. Carcinomatous metastases are not only the most frequent secondary foci but are more common than primary malignant tumors of the skeleton. For this reason a metastasis should always be considered in a differential diagnosis of all osseous lesions.

Metastatic carcinomatous growths of the jaws are rarely reported as compared with osseous foci elsewhere in the body. The reason for this is that many opportunities to overlook such foci exist. The routine technique for skull examinations produces overlap on both sides of the mandible and obscures evidence of pathology. Furthermore, in cases of carcinomatosis there is little indication for skeletal survey films unless complaints are directed toward specific bones. On rare occasions, however, secondary carcinoma is first discovered in the jaw and may precede identification of an unrecognized primary tumor.

Incidence

The frequency and site of skeletal metastases are difficult to ascertain. This is because of the fact that a skeletal survey on patients with cancer is not usually a routine procedure, or at time of death only a limited number of bones are examined. When particular attention has been paid to the skeleton at autopsy on cancer patients, as high as 30 per cent have shown bony metastases. Primary malignant neoplasms accounting for osseous metastases are—in their order of frequency—prostate, breast, kidney, lung, thyroid, and bladder.

The incidence of metastases to the jaws is not known, although the frequency is more than the reported cases would indicate. Primary tumors responsible for jaw metastases in our patients, in their order of frequency, were carcinoma of the breast, thyroid, lung, kidney, and pancreas, and reticulum-cell sarcoma. From a more regional location metastases occur from the lip, nasopharynx, and parotid.

Pathology

There are numerous preformed anatomical pathways in the body by way of which a malignant tumor can disseminate The common routes are tissue spaces lymphatics and blood vessels The cancer cells are usually transported by the lymphatics to the arterial blood stream through which they are considered to be carried to the bone marrow The venous systems caval portal and pulmonary less frequently carry emboli to the general circulation although these are the common path ways for the sarcomas

Recently a fourth system of veins the vertebral system has been postulated to explain the characteristic and dependable pattern in which dissemination of carcinomas of certain organs, which cannot be explained by the ordinary mechanisms of infiltration lymphatic or arterial spread, occurs without involvement of intervening organs or tissues This path way for emboli is particularly evident for skull brain and jaw metastases

The vertebral venous system consists of the epidural and perivertebral veins the venous vasovasorum of the large vessels of the extremities as far as the knee and elbow the veins of the thoracoabdominal wall the veins of the skull and neck, and the large intracranial sinuses of the brain The main trunk of this system consists of the innumerable inter twining vessels within and about the vertebra connected at every somite by the lumbar and intercostal veins with the cava, azygous and pelvic veins draining the thoracoabdominal cavities.

The vertebral veins are immature and embryonic in type They are large thin walled venous lakes without valves with a slow frequently reversing blood flow largely encased in bone and so protected from the *direct* driving effect of muscle contraction or the rise and fall of intra abdominal or intrathoracic pressures Their chief function appears to be that of a large blood reservoir similar to that of the liver or spleen In addition however an important subsidiary action exists as a by pass in which, under conditions of increased intraabdominal or intrathoracic pressure as the normal blood flow through the cava or portal systems shut off blood may be driven into the vertebral venous system and by pass the lungs and liver on its way to the heart.

It is apparent that the vertebral system of veins represents a potential pathway activated by a cough or strain by which malignant cells may be shunted from the more common pathways into the bones of the pelvis, spine, skull, or within the brain Experiments performed on the cadaver the mouse and on living man support the view that such a pathway can by pass the lungs and liver in reaching the greater cir culation This may be the explanation of the association of breast renal and thyroid carcinomas and bone metastases (without coincident in

volvement of the lungs), the peculiar affinity of adenocarcinoma of the prostate for the spine and pelvis, and for the failure as a rule of metastases to bones beyond the elbow or knee

The metastatic growth may be solitary or multiple, but is far more often multiple The distribution of metastases is quite constant no matter where the primary is situated, and the heaviest concentration of tumor growth is usually in the ribs, vertebra, pelvis and femur There are numerous exceptions to these common loci

The secondary bone tumor may predominantly destroy bone (osteolytic) or be responsible for the production of new bone (osteoblastic) Certain tumors characteristically are osteoblastic (prostatic carcinomas) while others are osteolytic (thyroid, kidney, and lung)

Changes in the blood are associated with extensive and widespread metastatic carcinomas If a major portion of the bone marrow is replaced by such lesions, a myelophthisic anemia (bone marrow replacement syndrome) may develop The anemia is associated with a reticulocytosis and nucleated red blood cells The number of white blood cells may be normal but frequently is increased to such an extent that the condition is referred to as leukemoid With such a blood picture (leukemoid) a leukemia may have to be ruled out The blood picture at times has a superficial resemblance to that seen in pernicious or other macrocytic anemias However, in the bone marrow replacement syndrome the nucleated red blood cells and the elevated level of reticulocytes are out of proportion to the degree of anemia present Megaloblasts found in pernicious anemia are never present in myelophthisic anemia. The values of the mean corpuscular hemoglobin and the mean corpuscular volume are lower than normal in the latter condition and above normal in macrocytic anemias The blood calcium may be elevated when there are secondary tumor deposits in bone, and particularly when they are extensive and lytic in type The serum phosphatase level is more frequently elevated above normal when the metastases are of the osteoblastic type but may also be elevated when the bone metastases are lytic

Clinical Characteristics

It should be constantly kept in mind that the jaws are rarely the initial site of metastatic carcinoma

Peripheral lesions are situated in alveolar bone and usually present as a visible, partly ulcerated outgrowth around the teeth or on the ridge Even with a short history, such roentgenographic evidence of bone invasion is characteristic not only of metastatic tumor but of primary carcinoma as well The teeth may separate and loosen, and the alveolar ridge may be extensively invaded Such changes will displace dentures

Pain, usually mistaken for toothache or neuralgia, is present from the onset.

Central lesions arise either in the spongiosa of the mandible or in the maxilla. The primary symptom is usually an aching pain with subsequent anesthesia of the lower lip or of the anterior gingiva in maxillary lesions. An expansion of the body of the mandible occurs with a widening and bulging of the lingual as well as the buccal plate to obliterate the buccogingival groove. When the maxilla is involved, the signs and symp-



FIG 18 1—Metastasis from carcinoma of the breast arising in the bone and gingiva, supporting the lateral cuspid teeth.

toms are similar to those for primary carcinoma of the antrum. Cortical erosion with ulceration or pathologic fracture often occurs.

The patient presenting a metastatic tumor of the jaws is usually one with advanced carcinomatosis, the primary site of which is usually known through the history of having been treated for carcinoma. Rarely a patient presents with a metastasis without a definite demonstrable primary or disseminated disease. Even more rarely the primary site of disease remains occult.

Roentgenographic Appearance

The tumor embolus usually lodges in the spongiosa of the bone where growth and destruction are first detected roentgenographically. Later erosion and expansion of cortical bone of the body of the mandible produces a central osteolytic process with a lacelike irregular destruction of the trabeculae. Occasionally the margins of the central defect appear more definite and punched-out, although if more roentgenograms are taken from different angles ragged edges caused by invasion of cancer are usually seen on one or more margins. The peripheral alveolar lesions invariably appear as typical lacelike bone destruction indis-





tinguishable from a primary carcinoma of the gingiva Osteoblastic metastases are uncommon in the jaws

Diagnosis

Certain clinical and roentgenographic generalizations have been made which are helpful in determining the primary sites for patients with skeletal metastases. In general, osseous lesions in young adults are more likely to be primary bone tumors whereas those occurring in patients over the age of thirty must always be considered metastatic tumors Verification of the primary carcinoma is not usually difficult, except in the rare occult tumors An even more difficult problem arises with the single skeletal metastasis An aspiration or open biopsy is necessary for a diagnosis

Treatment

The discovery of a bone metastasis represents a decisive phase in the clinical course of a neoplastic process. It signifies that the disease has become disseminated by way of the blood stream. Presence in the jaws indicates that the metastases have become multiple that cure has become an impossibility and that palliative therapy only is indicated

Solitary metastasis to the jaw bone is exceedingly rare. Should it occur without a demonstrable primary lesion, surgical extirpation is indicated, as well as a continued effort to locate and eradicate the primary growth. A solitary metastasis with a resectable primary lesion requires surgical removal of both.

Patients with disseminated disease from carcinoma of the breast, prostate thyroid and the malignant lymphomas may be treated effectively by a combination of modalities for prolongation of their lives

Carcinoma of the breast metastasizes to the skeleton in 25 to 35 per cent of cases The treatment aimed at the highest possible degree of palliation, consists of roentgen therapy in combination with different ancillary methods. Roentgen therapy is primarily aimed at relieving pain retarding growth activity in local areas where indicated, and delaying or avoiding pathologic fracture

Estrogen stimulation appears to accelerate the growth of metastatic breast carcinoma in women under fifty while surgical castration will effect striking benefits in certain of these cases Supplementation of surgical and roentgenographic treatment with androgens is frequently required. In older females administration of androgens or estrogens has given good results Those females receiving benefit from ovarian sterilization may later derive additional palliation from adrenalectomy or possibly from hypophysectomy

Carcinoma of the prostate metastasizes to the skeleton in the same



tinguishable from a primary carcinoma of the gingiva. Osteoblastic metastases are uncommon in the jaws

Diagnosis

Certain clinical and roentgenographic generalizations have been made which are helpful in determining the primary sites for patients with skeletal metastases. In general osseous lesions in young adults are more likely to be primary bone tumors whereas those occurring in patients over the age of thirty must always be considered metastatic tumors. Verification of the primary carcinoma is not usually difficult except in the rare occult tumors. An even more difficult problem arises with the single skeletal metastasis. An aspiration or open biopsy is necessary for a diagnosis.

Treatment

The discovery of a bone metastasis represents a decisive phase in the clinical course of a neoplastic process It signifies that the disease has become disseminated by way of the blood stream. Presence in the jaws indicates that the metastases have become multiple that cure has become an impossibility and that palliative therapy only is indicated.

Solitary metastasis to the jaw bone is exceedingly rare Should it occur without a demonstrable primary lesion, surgical extirpation is indicated, as well as a continued effort to locate and eradicate the primary growth. A solitary metastasis with a resectable primary lesion requires surgical removal of both.

Patients with disseminated disease from carcinoma of the breast, prostate thyroid, and the malignant lymphomas may be treated effectively by a combination of modalities for prolongation of their lives.

Carcinoma of the breast metastasizes to the skeleton in 25 to 35 per cent of cases The treatment, aimed at the highest possible degree of palliation consists of roentgen therapy in combination with different ancillary methods Roentgen therapy is primarily aimed at relieving pain retarding growth activity in local areas where indicated, and delaying or avoiding pathologic fracture

Estrogen stimulation appears to accelerate the growth of metastatic breast carcinoma in women under fifty while surgical castration will effect striking benefits in certain of these cases. Supplementation of surgical and roentgenographic treatment with androgens is frequently required. In older females administration of androgens or estrogens has given good results. Those females receiving benefit from ovarian sterilization may later derive additional palliation from adrenalectomy or possibly from hypophysectomy

Carcinoma of the prostate metastasizes to the skeleton in the same





shable from a primary carcinoma of the gingiva Osteoblastic tases are uncommon in the jaws

iosis

tain clinical and roentgenographic generalizations have been made are helpful in determining the primary sites for patients with al metastases In general osseous lesions in young adults are more to be primary bone tumors whereas those occurring in patients the age of thirty must always be considered metastatic tumors cation of the primary carcinoma is not usually difficult except in ire occult tumors An even more difficult problem arises with the skeletal metastasis. An aspiration or open biopsy is necessary for gnosis.

ment

e discovery of a bone metastasis represents a decisive phase in the al course of a neoplastic process It signifies that the disease has ne disseminated by way of the blood stream Presence in the jaws ates that the metastases have become multiple that cure has be an impossibility and that palliative therapy only is indicated.

itary metastasis to the jaw bone is exceedingly rare Should it without a demonstrable primary lesion, surgical extirpation is ated, as well as a continued effort to locate and eradicate the pri growth. A solitary metastasis with a resectable primary lesion res surgical removal of both.

ients with disseminated disease from carcinoma of the breast, ate, thyroid, and the malignant lymphomas may be treated effec by a combination of modalities for prolongation of their lives

rcinoma of the breast metastasizes to the skeleton in 25 to 35 per of cases The treatment, aimed at the highest possible degree of ition consists of roentgen therapy in combination with different iary methods Roentgen therapy is primarily aimed at relieving retarding growth activity in local areas where indicated, and de- g or avoiding pathologic fracture

trogen stimulation appears to accelerate the growth of metastatic st carcinoma in women under fifty while surgical castration will t striking benefits in certain of these cases. Supplementation of sur and roentgenographic treatment with androgens is frequently re ed. In older females administration of androgens or estrogens has n good results. Those females receiving benefit from ovarian sterili n may later derive additional palliation from adrenalectomy or pos from hypophysectomy

arcinoma of the prostate metastasizes to the skeleton in the same

frequency as does that of the breast Roentgen therapy has only limited usefulness in relieving pain in active areas in weight-bearing bones. Castration or estrogen therapy deserves first consideration and when the full benefit has been obtained from one, then the other may be employed The palliative result from this therapy is often dramatic.

Carcinoma of the thyroid frequently gives rise to skull metastases. Control may be accomplished with radioactive iodine Roentgen therapy is applied locally, with prompt relief, to symptom-producing osteolytic lesions Primary carcinomas in other organs rarely produce metastases to the jaws.

Certain chemicals, i e , nitrogen mustard and related compounds, are being tried for various types of carcinomatoses and lymphomas, but as yet their effectiveness has not been determined.

READING REFERENCES

BATSON, O V "The vertebral vein system as a mechanism for the spread of metastasis," *Am J Roentgenol Radium Therapy* 48 715–718 (1942)

PELTIER, L F , L B THOMAS, T H C BARCLAY, and A J KREMEN "The incidence of distant metastases among patients dying with head and neck cancers," *Surgery* 30 827 (1951).

SALMAN, I , and I LANGEL "Metastatic tumors of the oral cavity," *Oral Surg Oral Med Oral Pathol* 7 1141–1149 (1954)

SHERMAN, R S 'Resumé of the roentgen diagnosis of tumors of the jawbones,' *Oral Surg Oral Med Oral Pathol* 4 1427 (1951)

STERLING, J A , G C TASSMAN, and R GOLDSMITH "Solitary metastatic lesions to the gingivae masquerading as inflammation," *Oral Surg Oral Med Oral Pathol* 7 403–405 (1954)

STEWART, E E , and K W BRUCE "Mandibular tumor metastasized from a hypernephroma,' *J Oral Surg* 11:252 (1953)

WALDRON, C. A "Metastatic carcinoma of the mandible, adenocarcinoma of the lung with metastatic lesion of mandible as first clinical sign," *Oral Surg Oral Med Oral Pathol* 5 185 (1952).

Introduction to Part Four

Diseases and lesions simulating tumors are considered together since their reaction to unfavorable circumstances and deleterious agents such as physical and chemical injury nutritional and metabolic disturbances and environmental and heritable factors is nonneoplastic in character

Certain conditions such as the dysplasias Paget's disease etc are largely of a connective-tissue response Others are of a granulomatous nature, such as the giant-cell granulomas and the histiocytoses Another group the odontomas is composed of mixed epithelial and connective-tissue components

Osteogenesis of the jaws begins in the mesoderm During fetal life centers of ossification are established through the direct conversion of the mesenchyme to membranous bone, although in certain areas the ossification is preceded by the formation of cartilage The formation of the jaws is on a definite time schedule which partly accounts for the characteristic age incidence and selective sites of certain diseases, as well as the varied effects of adverse mechanical factors on the jaws

Cells of any one type do not necessarily mature on the same time schedule In addition to showing variations in rate of differentiation some may remain at a persistently low level. The latter are referred to as mesenchymal or epithelial reserve cells which upon receiving an appropriate stimulus are capable of resuming differentiation and division Many of these cells may revert to a simpler undifferentiated state following which they may redifferentiate along a course different from the one originally taken Thus the appearance of cementumlike bone structures in fibrous dysplasias in areas of the jaw completely removed from the teeth may be explained on a nonodontogenic basis While the concepts of tissue specificity may find some support in the development of the hamartia (odontomas) the great majority of the mesenchymal lesions appearing in the jaws probably arise as the result of metaplasia of non specialized cells reacting to abnormal histogenetic stimuli. The fibrous dysplasia group including the central fibroma and the fibromyxoma of the jaws may more properly be explained on this histogenetic basis than on the basis of origin in embryologically displaced tissues

PART FOUR

Quasi-tumors of the Jaws

CHAPTER 19

THE EXOSTOSES

Exostosis, torus palatinus torus mandibularis and enostosis are all hyperplastic growths of cortical bone with varied anatomic origin and etiology They are nonneoplastic and have limited growth potentials They are not complicated by infection or sarcomatous changes

EXOSTOSIS

An exostosis may be either of a compact or eburnated type with only a few or no Haversian systems or of a spongy type with more or less dense cancellous bone Exostoses may be pedunculated or sessile are continuous with the underlying cortical bone, and do not have a cartilaginous cap Generally these tumors are of no clinical significance, but the preparation of edentulous mouths for the reception of dentures may occasionally require their removal.

Multiple exostoses are rarely seen, although a large number may be present over the external alveolar plates particularly of the maxilla. In certain patients this condition is associated with exostoses over the bones of the skull. This condition is not related to hereditary multiple exostoses which are not exostoses but osteochondromas

Clinically these exostoses are observed as single or multiple small lumps over the external alveolar surface. They usually appear during childhood but rarely attain a size of more than a centimeter in diameter Roentgenographically they appear as bony outgrowths of uniform, dense cortical bone. Excisions should include a thin layer of cortical bone at the base since exostoses have a tendency to recur

TORUS PALATINUS

Torus palatinus is a form of exostosis which develops from the vault of the palate along the suture line and is characterized by an elongated outgrowth along the suture line of the palatal processes

These lesions are seen in approximately 20 per cent of the general population However torus palatinus has an affinity for the American Indian and Eskimo races among whom the occurrence is as high as 60 per cent, which would indicate a greater susceptibility in the mongoloid than in the caucasoid or negroid races The lesions usually appear after puberty, although they have been observed in young children Females are affected approximately twice as frequently as males

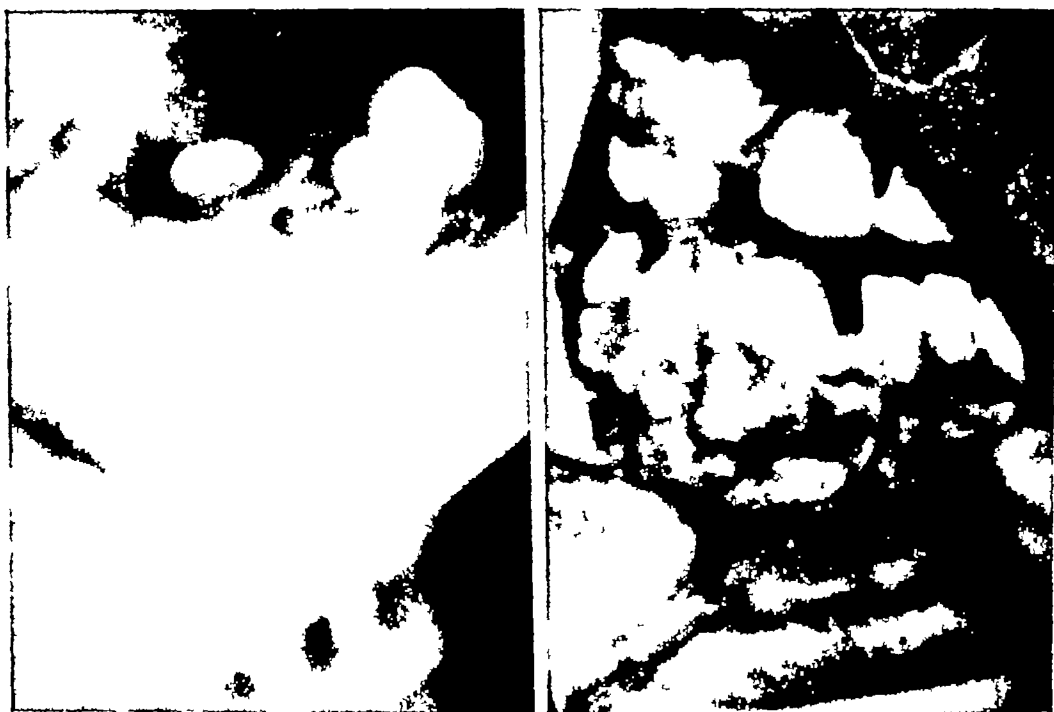


FIG 19 1 (*Left*)—A single exostosis covered by an advanced type of leukoplakia

FIG 19 2 (*Right*)—Multiple exostoses over the external and internal surfaces of the alveoli of the maxilla and mandible The teeth show some displacement which is undoubtedly associated with the lesions

Numerous opinions have been advanced for the cause of torus palatinus The functional demands and excessive development of the masticatory mechanism is a commonly accepted cause Strong mastication produces tension upon the median palatine suture, and the thickening of the palatine vault then acts as a buttress to resist this force The high incidence among Indians and Eskimos and the heavy masticatory requirements of their diets support this contention This tension theory is affirmed by the development of osteochondromas at sites of tendinous attachments to the appendicular skeleton The continued growth of the palatal processes results in lipping and downgrowth into the palatal vault.



FIG 19 3—Spindle-shaped anterior torus palatinus located over the incisive foramina adjacent to the alveolar ridge



FIG 19 4 (*Left*)—Bilobulated torus palatinus the anterior portion extending to the incisive foramina and the posterior portion extending to the margin of the soft palate

FIG 19 5 (*Center*)—Multilobular torus palatinus occupying the median raphe of the hard palate with a division into roughly four quadrants indicating a four point origin.

FIG 19 6 (*Right*)—Bifid type of torus palatinus which is particularly susceptible to the collection of food particles between the marked concave surface of the palate and the torus.

The palatine torus may arise anywhere along the line of the medial raphe from the incisive papilla to the posterior border of the palatine bones The base is often distributed equally on both sides of the fissure, but the larger or nodular forms are multicentric in origin and are not always bilaterally equal The projection from the palate is usually round but may be flat, spindle, nodular or lobulated in shape Microscopically the lesion may be seen to be made up of cortical or trabecular bone or both and the covering is a dense mucoperiosteum



FIG 19 7—Nodular type of torus palatinus indicates a multiple origin

Usually the lesion is first observed in patients ten to thirty years of age, and the growth is so slow that they are unaware of its existence Growth is not continuous, the majority of these tori are self-limited, although a few attain a size sufficient to cause speech difficulties Abrasions, burns and ulcers produced by food contacts are seen with some frequency over the most pendant portions of these enlargements, and inflammation may arise in the crevices of the lobulated type. Persistent superficial ulcers in the overlying mucosa should be regarded with suspicion since carcinomas occasionally are seen over these protuberances

Tori are radiopacities in the midline of the palate, usually equally distributed to the right and left, but varying greatly in outline. On the occlusal film the bonelike tumor is superimposed on the palatal shadow, while on the lateral roentgenogram of the face it is seen as an area of increased bone density infraimposed on the palate

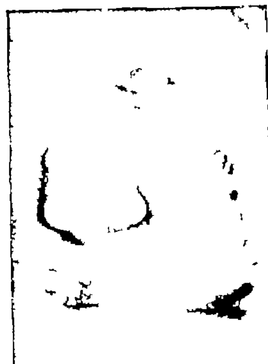


FIG 19 8—Lobulated torus palatinus to the right of the midline—an unusual formation



FIG 19 9—Bulbous-shaped torus palatinus filling the anterior two-thirds of the palatal vault.

The history of a uniform hardness in the midline of the palate present over a period of years with little or no increase in size. is enough to establish a clinical diagnosis of torus If, in addition a smooth, marginated density is seen on the roentgenogram, it is seldom necessary to consider a neoplasm in the differential diagnosis

Tori have no pathologic significance and attention is given them only when they cause symptoms or when they complicate the application of dentures At such times, only, is excision indicated.



FIG. 19·10 [illegible] palatinus with an ulceration along the right posterior border [illegible] denture

FIG. 19·11 (Right) [illegible] patient as in Fig 19·10, showing the denture in place

TORUS MANDIBULARIS

Torus mandibularis presents as a submucosal, hard, rounded, or oval mass fixed to the jaw, and is covered with normal mucous membrane

Mandibular tori are observed about one-third as frequently as the palatal type Sex and race distribution does not reveal any significant difference The age at time of first discovery is about thirty years

The etiology is similar to that given for the palatal type of tori, in that abnormal occlusal pressures and muscle tension are thought to be important factors

The usual site for these tumors is on the lingual surface in the premolar region along the junction of the alveolus with the body of the mandible They are visible and palpable, smooth, rounded, bony protuberances on



FIG 19 12—Bilateral and symmetrical tori mandibulars The lesions are well circumscribed masses of increased bone density and are of no significance except for interference with denture construction.



FIG. 19 13—Hyperplasia of the geniotubercules In edentulous mouths with a completely resorbed alveolar process, the lesion is due to excessive pressure from a denture and has some of the appearance of soft tissue hypertrophy

FIG 19 14—Periostitis in the geniotubercules with extension into the cortex of the mandible

a broad sessile base and are most frequently bilateral although seldom bilaterally symmetrical

Microscopically, the torus mandibularis is seen to be composed of a dense cortical type of bone with little if any trabecular bone

Tori mandibularis are as a rule symptomless They are often multiple and, on an exceedingly rare occasion, may require removal because of rapid growth and displacement of prosthetic devices

Anatomic position, together with roentgenographic findings of uniformly dense spherical masses near the roots of the cuspid and premolar teeth, is diagnostic

The rare surgical removal of these lesions is somewhat complicated by the extreme density of the involved bone

THE ENOSTOSES

An enostosis is a rare, nonneoplastic growth of cortical bone It is symptomless and occurs equally in the maxilla and mandible The pathology is the same as for exostosis except for its origin in the inner aspect of the cortex and its location in the trabecular bone It is usually first seen on routine roentgenographic examination as a radiopaque, irregular area of varying size The periphery of the lesion merges into the surrounding bone somewhat as in condensing osteitis, but this lack of margin and irregularity of contour distinguish it from an osteoma or other benign neoplasms Treatment by excision is indicated only for symptomatic relief

READING REFERENCES

KOLAS, S V HALPERIN, K JEFFERIS, S HUDDLESTON, and H B G ROBINSON "The occurrence of torus palatinus and torus mandibularis in 2478 dental patients," *Oral Surg Oral Med Oral Pathol* 6 1134–1141 (1953)

THOMA, K H J D HOLLAND, JR, H W WOODBURY, J G BURROW, and E L SLEEPER "IV, Contributions to the oncology of the jaws," *Oral Surg Oral Med Oral Pathol* 1 40–66 (1948)

CHAPTER 20

Fibrous Dysplasia

Fibrous dysplasia is now recognized as a definite clinical and pathologic entity and the term encompasses certain lesions in which normal bone is characteristically replaced by fibrous tissue containing variable amounts of metaplastic bone There are three distinct clinical types of fibrous dysplasia, i.e polyostotic, monostotic, and periapical which apparently have no common etiologic background but have the same pathologic features Periapical fibrous dysplasia has long been designated as cementoma Each of these clinical entities has an identical histopathologic feature the replacement of the spongiosa and the medullary cavities of the jaws with fibrous connective tissue containing bone

The polyostotic type will be discussed briefly because of its different clinical manifestations and also because it is less frequently seen as an oral problem.

POLYOSTOTIC FIBROUS DYSPLASIA

The name "polyostotic fibrous dysplasia" has only recently been proposed as a generic term to include bony lesions previously reported under a wide variety of names i.e., osteodystrophia fibrosa unilateralis with pubertas precox, and osteitis fibrosa disseminata with areas of pigmentation and precocious puberty in the female This disease occurs predominantly in females It is manifested by such signs and symptoms as (1) bony swelling and deformity (2) premature sexual maturation, (3) premature skeletal growth and maturation (4) patchy skin pigmentation.

Etiology

The explanation for this syndrome is speculative. Some investigators believe that polyostotic fibrous dysplasia is primarily a disturbance of the central nervous system (hypothalamus) since hypothalmic lesions are known to be responsible for precocious puberty while others believe

that it is due to perverted activity of the bone-forming mesenchyme No definite precipitating factors have been determined

Pathology

Because of the similarity of gross and microscopic bone pathology, the details are discussed under the monostotic variety The skin pig-



FIG 20 1—Polycystic fibrous dysplasia with a dense sclerotic radiopacity of the left maxilla and zygoma with partial obliteration of the antrum

mentation is due to an increase in melanin in the basal layer of the epithelium

Clinical Characteristics

The symptoms depend largely on the particular bone affected, and the more severe involvements are usually observed in those patients whose histories reveal clinical complaints in childhood or adolescence Ordinarily, symptoms of pain and a limp are noticed where the lower

extremities are affected on the other hand the condition may be present for years and not be discovered until adult life

Skeletal Manifestations Signs of swelling are usually late although the general contour of the bones may show some expansion most readily



Fig 20 2—Same case as in Fig 20 1 showing a dense sclerosis with periapical as well as a diffuse involvement. In the mandible the process is in the fibrous stage and the margin is well circumscribed as compared with the disease in the maxilla.

noted in the ribs, skull, and jaws Fibrous dysplasia of the maxilla is the predominant cause of leontiasis ossea. Involvement of the long bones with thinning of the cortex may result in pathologic fractures an uncommon complication in the jaws

The disease may be moderate or severe Where only a few bones

are involved, the lesions may be confined to a single limb, while severe cases may have all bones or any combination of bone involvement In the most severe cases, the disease tends to be even more widely scattered, and unilateral involvement is seldom observed The skull is almost invariably involved When bone destruction is most rapid, pathologic fractures are frequent in the long bones

Nonskeletal Manifestations The various nonskeletal changes appear predominantly in the more severe forms of the disease Pigmentation of



FIG 20 3—Same case as in Figs 20 1 and 20 2, showing in detail the odontic involvement as related to the diffuse maxillary disease

the skin in childhood is concomitant with skeletal lesions Approximately 50 per cent of the patients will present a history of hyperpigmentation appearing in patches or blotches, yellow-brown to dark-brown in color The pigmented areas may be observed anywhere on the body, but are somewhat more frequent on the scalp, the face and neck, or the thighs and limbs They are rarely distributed in a unilateral pattern or positionally related to the skeletal foci The pigmentation in the skin is similar in color to that seen in von Recklinghausen's neurofibromatosis, but the patches have margins that are irregular rather than smooth

The premature sexual maturation, pubertas precox, apparently appears only in females and is present in approximately 40 per cent of cases Catamenia appears at an unusually early age It is associated with enlargement of the external genitalia and with the appearance of other secondary sex characteristics

Premature skeletal growth and maturation occur in severe forms of fibrous dysplasia and closure of the various centers of ossification occurs early The affected children are conspicuously large at an early age, but growth not infrequently ceases prematurely and the full adult stature may not be attained because of premature epiphyseal closure

Hyperthyroidism has been noted in young patients with the more severe form of fibrous dysplasia but it is usually mild and seldom requires specific therapy

Diagnosis

The roentgenographic findings in this form of the disease simulate those of the monostotic type except for multiplicity of lesions

A presumptive diagnosis in the moderate and severe forms of this disease offers little difficulty because most of the clinical characteristics are present. In the least severe forms when the manifestations are less obvious, the diagnosis is more dependent on adequate roentgenographic studies and microscopic examination of the tissue removed from accessible lesions. The usual blood chemistry examinations in the study of diseases of bone show levels within normal limits with the exception of the serum phosphatase level which may be slightly elevated. However in no case may the final diagnosis be safely made without biopsy

The local roentgenographic features of hyperparathyroidism may be identical to the skeletal lesions of fibrous dysplasia, and only the generalized osteoporosis and disappearance of the lamina dura of teeth distinguish hyperparathyroidism The characteristic sclerotic thickening of the base of the skull is an additional feature observed in most patients with fibrous dysplasia In hyperparathyroidism the blood calcium and phosphatase levels are elevated, and renal calculi are common. In any case, an exploration for parathyroid adenomas before a bone biopsy is seldom warranted

The skull lesions of osteitis deformans may simulate those of fibrous dysplasia although the former process is more frequently bilateral, occurs in an older age group and features a high phosphatase value.

The cystic bone lesions of neurofibromatosis often cannot be differentiated roentgenographically from those seen in fibrous dysplasia, although the subperiosteal and cortical pressure erosions are more common in neurofibromatosis.

Hand-Schüller-Christian disease also occurs in the younger age group, and the roentgenographic features are quite similar to those of fibrous dysplasia, except that the skull involvement is more extensive, the lesions have a punched-out or lytic appearance, and cortical expansion is less pronounced.

Treatment

Surgical treatment is justified for any lesion giving rise to pain, causing interference with function or producing deformity Surgical exposure, curettage and implantation of bone chips are recommended, although if removal is incomplete the lesion may recur In the more extensive mandibular lesions and even in moderate maxillary involvement, resection is often necessary

Prognosis

The spontaneous disappearance of bony lesions of polyostotic fibrous dysplasia has not been observed although they may reach a sclerotic state and remain static indefinitely Local surgery produces excellent results Rarely sarcomatous changes are seen, but invariably not until many years after the onset

CHERUBISM

Cherubism (familial intraosseous fibrous swellings of the jaws) is an abnormality characterized by a benign firm, painless swelling which usually occurs bilaterally at the angles of the mandible Initiation is in early childhood and generally follows a familial pattern It has not been described at birth

Etiology

The etiology of cherubism is not known Some consider it to be related to the dental system because of the agenesis of some of the teeth at the site of the tumor, but this theory is not supported by microscopic studies The more likely supposition is that it is a form of polyostotic fibrous dysplasia Trauma is not known to be an inciting factor

Pathology

The gross appearances are characteristic, but the microscopic features are quite diversified Although bilateral involvement of the angles of the mandible is typical less frequently the incisor region and the tuberosity of the maxilla, and even more rarely the entire mandible, are involved

The histologic changes vary in different areas within the same lesion, and from case to case Many tissue areas superficially resemble a giant-cell tumor of bone, but the stroma is generally more of a spindle-cell fibroblastic variety with metaplastic bone formation Focal areas with cellular deposits of hemosiderin zones of hemorrhage, foreign-body giant cells, and well-filled capillaries lined with plump endothelial cells are

present. These features shoud not be confused with those of giant-cell tumor as they are secondary changes in fibrous dysplasia.

1 The disease is always bilateral when the angle is involved Rarely when the tuberosity of the maxilla or the symphysis of the mandible is a site of occurrence the disease may be unifocal
2. In spite of the probable genetic origin of this disease, there is no visible or roentgenographic evidence present at birth, but the deformity appears during early childhood. Growth slowly progresses for a variable period of years but then subsides Regression follows with a gradual improvement of the facial appearance, and at puberty the improvement is so great that there is usually no visible evidence of deformity However the roentgenograms continue to show moderate changes in spite of this clinical improvement
3. Ordinarily there are no complaints other than swelling deformity and malocclusion
4 Those cases followed into adulthood are symptom free and the only evidence of disease are changes shown roentgenographically and the absence of certain teeth.

The Clinical Characteristics

These children have a diffuse swelling of the lower half of the face, a tautness of the facial skin, a retraction of the lower eyelids and an appearance of looking upward

Roentgenographic Appearances

Roentgenograms of the jaws reveal an expanding cystlike bone destructive process without periosteal new bone formation. The involved areas appear to be multiloculated but lack other characteristics of true cysts. The lesions are usually extensive with involvement from the angles forward to at least the first molar areas and posterosuperiorly into the ascending rami Lesions of the symphysis or of the tuberosities of the maxillae are also extensive.

In the majority the six year molars are absent, and those patients who are followed into adulthood often fail to develop the other permanent molars. Concomitant involvement of other bones in the skeleton is extremely rare.

LEONTIASIS OSSEA

The term *leontiasis* (lion face) was originally applied to the deformities produced by leprosy in the skin of the face In addition, the term *leontiasis ossea* is applied to several tumors or diseases which produce enlargement of one or more of the facial bones Leontiasis ossea is a

descriptive term only, and identification of the specific disease process is made by clinicopathologic examination

Incidence

This rare condition develops as a rule during puberty, and the majority of the cases have their onset before the age of twenty but may not become manifest before middle life Both sexes are affected equally

Etiology

Since this is not a pathologic entity but rather a term representing several diseases affecting the jaw bones and calvarium, the pathogenesis varies and the causal factors are unknown. The majority of cases arise in association with fibrous dysplasia Paget's disease is a less frequent cause Diffuse productive osteitis and various tumors of the maxillae produce this condition

Pathology

The sites most often affected are the nasal, malar, maxillary, mandibular, frontal, and parietal bones The incipient stage is unilateral, but over a period of years the condition becomes bilateral and may even involve the whole skull While the involved osseous structures may be markedly enlarged the overlying skin and soft tissues are not affected The gross and microscopic appearances are described under their respective disease entities

Clinical Characteristics

The usual history is prolonged, with a gradually increasing facial deformity without symptoms other than swelling The deformity often starts in the maxilla but may affect any area in the jaws or the calvarium The earliest subjective symptoms may be facial pain, neuralgia, nasal obstruction visual disturbances, or proptosis Later symptoms are produced by obliteration of osseous meati, with pressure on the cranial nerves These may include headache, partial or complete blindness, disorders of speech, and difficulty in mastication.

Roentgenographic Appearance

Because of the varied pathogenesis, the appearance may suggest any of the above-mentioned diseases In the majority of cases, bone destruction and expansion are demonstrated, with varying degrees of osteosclerosis The classic clinical and roentgenographic features may strongly suggest a descriptive diagnosis of leontiasis ossea, but biopsy will be required to identify the precise pathology.

Treatment

Palliative surgery to relieve pressure symptoms and to correct gross deformities is the preferred treatment. It is advisable however when ever possible, to delay surgery until the patient is well past puberty Although the chronicity of the disease is a constant feature leontiasis ossea is usually not fatal Facial disfigurement is the only symptom in 30 per cent of cases, and visual impairment is less frequent. If the latter appears it will do so before the age of twenty years.

MONOSTOTIC FIBROUS DYSPLASIA
(*ossifying fibroma fibro-osteoma and osteoma*)

Monostotic fibrous dysplasia is a single, localized, destructive lesion of the bone, due to the replacement of the marrow cavity by a well-differ entiated connective tissue with varying amounts of metaplastic new bone. Prior to 1936 this disease had not been well delineated from certain other bone lesions but more recently it has been shown to encompass several conditions in the jaws that were formerly considered specific entities. Such lesions as ossifying fibroma, fibro-osteoma, and osteoma are now considered to be morphologic variations of monostotic fibrous dysplasia. The periapical fibrous dysplasia (cementoma) had for years been considered an odontogenic tumor but as will be discussed later it, too is now considered a form of fibrous dysplasia.

Incidence

The monostotic form is more common than polyostotic fibrous dys plasia. The occurrence is predominantly in females (60 to 70 per cent) It is most commonly observed in the ribs, femur tibia, maxilla, calvarium, mandible, humerus, ulna, vertebra, pelvis and fibula, in that order These lesions usually have their inception in childhood, but the diagnosis is frequently made after puberty

Etiology

The etiology is not clearly understood. Some believe these lesions to be hamartomas, while others believe they represent a nonspecific abnor mal response to an injury, producing an overgrowth of connective tissue Support for the traumatic origin is suggested by the common rib involve ment. Many patients give a history of specific trauma, and a certain number have demonstrable roentgenographic evidence of a fracture. Development of dysplasia at the site of such a fracture, as long as eight years later has been reported.

Pathology

The gross examination usually shows the bone to be expanded, with the cortex quite irregularly thinned and easily fractured The shape may be fusiform or nearly spherical The cancellous bone and marrow are replaced by solid fibrous, yellow-white tissue containing small cysts filled with amber fluid The transition to normal marrow is abrupt. The lesion when sectioned, is hard, rubbery, and invariably gritty, because of innumerable minute spicules of bone The vascularity is decreased, and hemorrhagic areas are common

The microscopic study will disclose a substitution of the medullary cavity by connective tissue, in which the density of cells and collagen varies The connective tissue typically is feathery, but may be quite collagenized and may contain cartilage, cysts, and some giant cells. In the peripheral areas particularly, and more or less generally, the lesion contains trabeculae of coarse-fibered bone which arises from a metaplasia of the fibrous connective tissue The architecture of the normal trabecular bone is completely destroyed, the metaplastic bone quite frequently forms in geometric patterns, e g , circles and arcs of circles However, bony spicules of varying sizes and other shapes are seen in some areas of most lesions Foam cells and hemosiderin deposits are rarely seen, although hemorrhagic areas are common On rare occasions, fibrosarcomatous changes may be observed

When fibrous dysplasia occurs in the jaws, the morphologic variations from case to case are similar to those of fibrous dysplasia in other skeletal regions Because of these variations, the lesions commonly called ossifying fibroma, fibro-osteoma, osteogenic fibroma, and certain central fibromas are considered to be one and the same lesion—fibrous dysplasia

Clinical Characteristics

Monostotic fibrous dysplasia is often asymptomatic until adult life Not infrequently there is a history of trauma which occurred years previously in the affected area, with or without fracture. The most common presenting complaint is facial deformity, a swelling of the maxilla or of the body of the mandible, with or without local tenderness or pain These lesions usually progress slowly up to the time of puberty, and then active progression tends to subside as adulthood is reached However, such a tendency does not prevent a tremendous increase in size during adult life in some cases

Not infrequently a unilateral exophthalmos or blockage of one or both nasal passages and irregular displacement of teeth are present Pathologic fracture may occur, giving the patient the first inkling of the existence of this lesion



Fig 20 4 (*Upper*)—Monostotic fibrous dysplasia causing a dome-shaped expansion of alveolar and cortical bone with displacement of the cuspid tooth lingually and of the first bicuspid distally The overlying mucosa is of essentially normal texture and color This lesion was formerly known as ossifying fibroma.

Fig 20 5 (*Lower*)—Monostotic fibrous dysplasia involving the maxillae which has produced expansion of alveolar and cortical bone The nonspecific gingival granuloma is unrelated to the primary disease.



FIG 20 6 (*Upper*)—Monostotic fibrous dysplasia appearing as an expansile lesion of the right alveolar ridge The process involves the body of the maxilla and obliterates the antrum

FIG 20 7 (*Lower*)—Monostotic fibrous dysplasia (osteofibroma), producing a large, oval, bony-hard swelling involving the left maxilla

Abnormal pigmentation and endocrine disturbances are not observed. The serum calcium, phosphorus and phosphatase values are normal.

Roentgenographic Appearance

The appearance may vary from case to case, depending directly on the amount of bone destroyed and the amount and density of the meta plastic bone present in the lesion Replacement of normal bone results in an area of diminished density with mottled opacities The periphery of



FIG 20 8 (*Left*)—Monostotic fibrous dysplasia (so-called osteofibroma) arising centrally to produce a spherical area with altered fine trabeculae The periph eral margins are poorly defined.

FIG 20 9 (*Right*)—Monostotic fibrous dysplasia with a radiolucent, irregular and ill-defined margin surrounding the apex of the first bicuspid and extending from the cuspid to the second bicuspid teeth. Destruction of the lamina dura, absence of flare at the margin of the lesion, and the smudged homogeneous radiolucency help to distinguish it from a periodontal cyst.

the affected area is usually fairly well defined but often it shades off into normal bone without a perceptible line of demarcation This is especially true when the main portion of the lesion is seen with the homogeneous appearance of ground glass but many lesions are densely radiopaque Bone expansion with deformity may or may not occur The irregular destruction of cortical bone may produce a cystlike multi locular configuration with a dense and irregular periphery In the maxilla, the condition often represents a diffuse sclerotic hyperostosis (leontiasis ossea) and must be differentiated from osteitis deformans (Paget s disease)

Diagnosis

Following the summation of clinical data and local roentgen studies a confirmatory microscopic diagnosis must be made in all cases pre



FIG 20 10 (*Left*)—Monostotic fibrous dysplasia (fibrous state) located in the symphysis below the central incisor teeth It is distinguished from the periapical type by the persistence of the lamina dura

FIG 20 11 (*Right*)—Monostotic fibrous dysplasia occupying the symphysis, with expansion and destruction of alveolar and cortical bone



FIG. 20·12 (*Left*)—Monostotic fibrous dysplasia at the midline with a smudged, sclerotic central zone and with irregular areas of radiolucency at the periphery The zone of greatest radiolucency is odontic in position

FIG. 20 13 (*Right*)—The same case as in Fig 20 12, showing in closer detail the periapical portion of the lesion with only minimal disturbance of lamina dura and pseudocystic pattern of radiolucency However, the margins are ill defined



FIG 20 14—Monostotic fibrous dysplasia with a smudged mottled and ground glass appearance involving the posterior two-thirds of the mandible The bulk of the expansion is downward, producing a false impression of upward displacement of the mandibular canal The enameloma in the first molar bifurcation is not related to the basic disease.

senting radiolucent lesions of the jaws Besides the odontic and non-odontic cysts such lesions as ameloblastoma, traumatic bone-cyst, giant-cell tumor, osteitis deformans, solitary myeloma, and metatastic osteolytic lesions must be differentiated from dysplasia It must be kept in mind that any radiolucent lesion may be a local manifestation of a disseminated



FIG 20 15—Monostotic fibrous dysplasia expanding both body and ramus of the mandible The smudged fine trabecular pattern in the radiolucent areas and the irregular but almost homogeneous detail of the sclerotic areas present the classic features

or generalized disease Where clinical findings and laboratory studies indicate it, a roentgenographic bone survey may be done, i e, of the skull, thoracic cage, and pelvis

Treatment

Curettage with insertion of bone chips in the defect, or conservative excision with or without an immediate bone graft, is usually adequate treatment Irradiation is of value in relieving pain, and prolonged remission from growth of the lesion in some instances may occur under a conservative, extended radiation program

Prognosis

A monostotic fibrous dysplasia may progress to any degree of deformity and may spontaneously become static. Local surgery and curettage offer good prognosis Sarcomatous changes have rarely been reported.

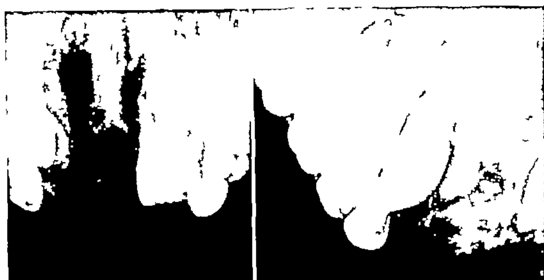


FIG 20 16 (*Left*)—Monostotic fibrous dysplasia producing large multiloculated, radiolucent areas with typical fine trabecular pattern and irregular lace-like sclerotic markings.

FIG 20 17 (*Right*)—Same case as in Fig 20 16 Tangential view showing in greater detail the fine variegated appearance produced by destruction and partial replacement of bone

PERIAPICAL FIBROUS DYSPLASIA
(*cementoma*)

Periapical fibrous dysplasia (cementoma) is a benign odontic lesion with distinctive clinical and roentgenographic findings The histologic characteristics duplicate those of the other fibrous dysplasias and are classified with them

Incidence

This lesion is common and is most often associated with the lower incisor teeth. It is found once in every 400 routine roentgen studies of the mouth and is more common in the Negro race Women are much more frequently affected than men It is rarely found in adolescents

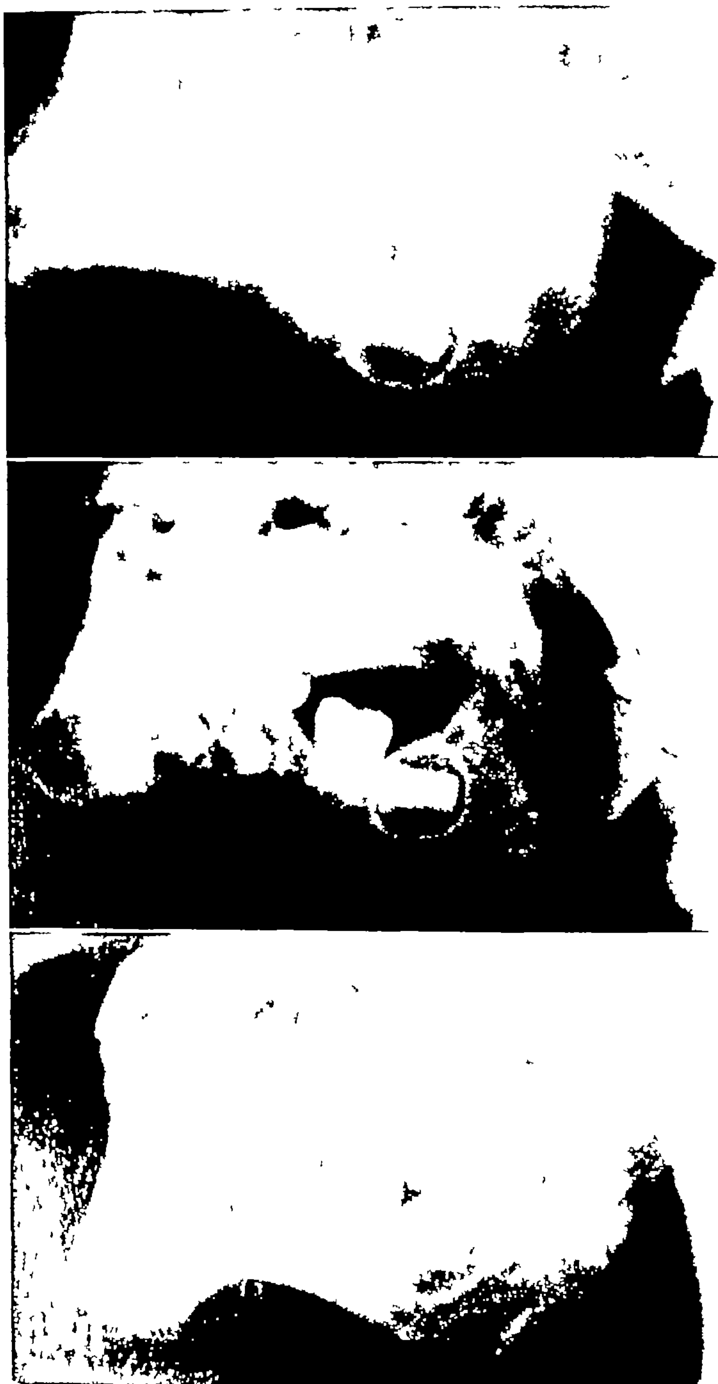


FIG 20 18 (*Upper*)—Monostotic fibrous dysplasia seen as an oval, nearly homogeneous radiolucent defect

FIG 20 19 (*Center*)—Same case as in Fig 20 18, following surgical exposure and curettage without disturbance to developing dental follicles

FIG 20 20 (*Lower*)—Same case as in Figs 20 18 and 20 19 one year following this surgical procedure with regeneration of bone and without evidence of recurrence (*Courtesy of Kenneth E Kipp, D D S*)

and is far more commonly observed in patients between the ages of twenty and sixty years

Etiology

The etiology is unknown. An inciting factor would appear to be trauma in susceptible individuals since the majority of these lesions are in the lower anterior area. A direct fall loosened teeth, or a continuous traumatic occlusion are believed to incite connective tissue production This lesion begins as a rather ill-defined slowly expanding connective-tissue growth, there are spicules of the primary type of bone which, as the disease progresses become denser and irregularly calcified The natural history of its evolution is that the fibrous calcified bone is gradually replaced by secondary or lamellated compact bone and a circumscribed densely compact structure results.

Pathology

The earliest phase of periapical dysplasia is the proliferation of the bone marrow connective tissue into a rather cellular and vascular structure with a moderate amount of collagen Later within this growth dysplastic bone of a coarse fiber type with wide osteoid seams and osteoid trabeculae develops This is typical of the histologic picture of fibrous dysplasia. The connective tissue becomes more dense and less vascular and as this sclerotic process progresses the new bone is replaced by secondary or lamellated compact bone until finally a dense sclerotic, well localized lesion is formed. This is the osteoma stage of fibrous dysplasia that was formerly called *mature cementoma* These structures are closely related to the periodontal membrane around the apex of a tooth, and the less dense peripheral zone is the more fibrous portion of the lesion This is a self limiting process, nonodontogenic and nonneoplastic.

Clinical Characteristics

Clinically these lesions rarely present subjective symptoms however neuralgia occasionally is present and less frequently expansion of bone is observed.

1. The majority of these lesions are located in the mandibular incisor and cuspid areas, although they are also seen in association with bicuspid and molar teeth. In the maxilla they occur less frequently and are usually limited to the anterior region.
2. The teeth affected are usually vital
3. Multiple periapical dysplasias are common.
4. Transition through several stages is observed.



FIG 20 21—Periapical fibrous dysplasia (cementoma) residual after removal of second molar tooth partially circumscribed by an irregular radiolucent line, and showing a slight smudgy opacity



FIG 20 22 (*Left*)—Periapical fibrous dysplasia (cementoma) is seen as an irregular radiolucent zone with a few remaining trabeculae The lamina dura ends abruptly at the margin of the lesion, whereas in the periodontal cyst it usually flares out to become a part of the margin

FIG 20 23 (*Center*)—Periapical fibrous dysplasia (cementoma) showing radiolucency, loss of bone detail, and lamina dura

FIG 20 24 (*Right*)—Periapical fibrous dysplasia (cementoma) with an irregular, dense, sclerotic appearance, surrounded by a radiolucent zone, which in turn is marginated by increased sclerosis



FIG 20 25 (*Left*)—Periapical fibrous dysplasia (cementoma) with a densely radiopaque irregular mass incompletely surrounded by a radiolucent zone

FIG. 20 26 (*Center*)—Periapical fibrous dysplasia (cementoma) with marked central sclerosis and broad peripheral radiolucency

FIG. 20 27 (*Right*)—Periapical fibrous dysplasia (cementoma) completely calcified with superior margins which are sharp but which blend into adjacent bone inferiorly



FIG. 20 28—Fibrous dysplasia of the osteoma eburneum type of the coronoid process.



FIG 20 29 (*Upper*)—Periapical fibrous dysplasia (cementoma) completely sclerosed with little evidence of a radiolucent periphery

FIG 20 30 (*Lower*)—Periapical fibrous dysplasia (cementoma) with a well-defined radiolucency (fibrous portion) involving more than one tooth, with a central sclerotic zone

a In the initial stage, proliferation of connective tissue will be demonstrated roentgenographically by a radiolucent zone which resembles an apical granuloma or a periodontal cyst

b In the intermediate stage the central portion becomes sclerotic, while the peripheral zone remains radiolucent Usually this stage also is symptomless

c In the mature stage the lesion may or may not be symptomless, depending on its size its proximity to nerves, and the degree of



FIG 20 31—Periapical fibrous dysplasia (cementoma) involving maxillary cuspid tooth in a completely sclerosed and eburnated stage



FIG 20 32—Fibrous dysplasia is seen in small multiple periapical foci in both maxillae and mandible.

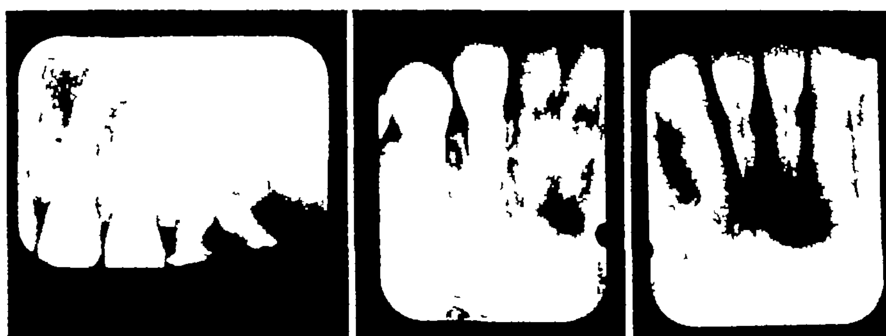


FIG 20 33—Multiple foci of periapical fibrous dysplasia (cementomas) associated with hypercementosis around the maxillary bicuspid teeth and with a single focus in the fibrous stage in the mandible



FIG 20 34—Individual foci of periapical fibrous dysplasia (cementomas) involving all the roots shown except the distal root of the second molar

traumatic occlusion The solid, radiopaque mass in the periapical region is characteristically surrounded by a thin, translucent peripheral zone, and the majority become static at this stage

5 These lesions have been followed roentgenographically from ten to fifteen years through this course of development Occasionally growth continues and becomes typical of the lesion designated as monostotic fibrous dysplasia

6 Periapical dysplasia remaining in the jaws after extraction of teeth may become exposed as the result of alveolar resorption, and the fibrous zone around the lesion may become infected Inflammatory reaction rarely exists under other circumstances

FIG 20 35—Multiple bilateral foci of fibrous dysplasia (cementomas) in an edentulous jaw Process is confined to the odontic areas of the mandible

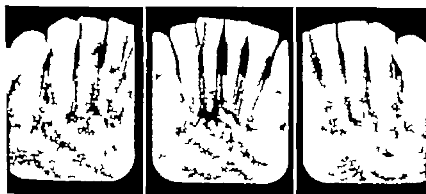


FIG 20 36—Multiple periapical involvements of fibrous dysplasia (cementomas) with a more generalized process on the left.

be differentiated from the dental granuloma by pulp vitality tests The mature lesion may be differentiated from condensing osteitis by its circumscription

Treatment

Surgical excision is the preferred treatment However, if this procedure will require the removal of a healthy, functioning tooth or the loss of alveolar bone sufficient to produce a serious restorative problem, the lesion may safely be observed until symptoms develop

READING REFERENCES

ALBRIGHT, F, A M BUTLER, A O HAMPTON, and P SMITH "Syndrome characterized by osteitis fibrosa disseminata, areas of pigmentation and endocrine dysfunction with precocious puberty in females, report of 5 cases," *New Engl J Med* 216 727–746 (1937)

BERNIER, J L, and R W TIECKE "Fibrous dysplasia," *J Oral Surg* 8 256–258 (1950)

BILLINGS, L, and N RINGERTZ "Fibro-osteoma, pathologico-anatomical and roentgenological study," *Acta Radiol* 27 129–152 (1946)

BRUCE K W, A BRUWER, and R L J KENNEDY "Familial intraosseous fibrous swellings of the jaw (cherubism)," *Oral Surg Oral Med Oral Pathol* 6 995–1014 (1953)

CAHN L R "Leontiasis ossea," *Oral Surg Oral Med Oral Pathol* 6 201–212 (1953)

CARSON, I H "Polyostotic fibrous dysplasia," *Oral Surg Oral Med Oral Pathol* 7 524–532 (1954)

JAFFE, H L "Giant-cell reparative granuloma, traumatic bone cyst, and fibrous (fibrous-osseous) dysplasia," *Oral Surg Oral Med Oral Pathol* 6 159–175 (1953)

JONES W A, J GERRIE, and J PRITCHARD "Cherubism—a familial fibrous dysplasia of the jaws," *Oral Surg Oral Med Oral Pathol* 5 292–304 (1952)

LICHTENSTEIN L, and H L JAFFE "Fibrous dysplasia of bone," *Arch Pathol* 33 777–816 (1942)

MITCHELL, R G, and W MACLEOD "Leontiasis ossea due to Albers-Schonberg's disease," *Brit J Radiol* 25 442–445 (1952)

SMITH, A G and A ZAVALETA "Osteoma, ossifying fibroma and fibrous dysplasia of facial cranial bones," *Arch Pathol* 54 507–527 (1952)

STAFNE, E C "Periapical fibroma roentgenologic observations," *J Am Dent Assoc* 30 688–692 (1943)

CHAPTER 21

The Reparative Granulomas

The giant-cell reparative granulomas have for years been confused with numerous lesions of the soft parts and osseous tissues The peripheral form has been included under the term *epulis* which is defined as an outgrowth from the free margin of the gingiva. This term now obsolete, was employed without regard to etiology or histogenesis Peripheral giant cell reparative granulomas should be distinguished from granulomas of hyperparathyroidism, fibromas fibroangiomas granular-cell myoblastomas and various nonspecific and specific granulomas The central or intraosseous giant-cell reparative granuloma should be distinguished from the exceedingly rare giant-cell tumor of bone.

Recognition of both types of reparative granulomas is essential before surgical therapy is considered. With a histologic diagnosis of this form of granuloma, one should determine that the patient is not suffering from hyperparathyroidism in order to avoid unnecessary and often destructive surgery

The two forms of reparative granuloma are considered together because of their natural history relation to trauma histologic appearances and similar therapy

Incidence

The peripheral type occurs most frequently in the second and fifth decades and the sexes are affected equally

The central type occurs most often in patients between ten and twenty five years of age, and females are more commonly affected than males

Etiology

Trauma is considered the inciting etiologic factor for both the peripheral and central reparative granulomas Bone along the crest of the alveoli is particularly susceptible to trauma and irritation. Extractions are the most common form of trauma, although direct blows with loosening of the teeth, chronic infection, irritation from prostheses and even the injudicious use of toothpicks are common inciting factors. A small

per cent of these lesions result from hyperparathyroidism Even in such cases trauma may be involved as a local inciting factor

Pathology

Giant-cell reparative granulomas are not tumors but reparative processes the structural characteristics of which may be understood when it



FIG 21 1 (*Upper left*)—Peripheral giant-cell reparative granuloma in a nine-year-old child recurrent following extraction and curettage

FIG 21 2 (*Upper right*)—Peripheral giant-cell reparative granuloma in a seven-year-old child, recurrent following incision and curettage

FIG 21 3 (*Lower left*)—Peripheral giant-cell reparative granuloma in an adult appearing as a reddish, smooth, polypoid tumor mass, arising from the interdental papilla

FIG 21 4 (*Lower right*)—Peripheral giant-cell reparative granuloma producing separation of teeth, with labiolingual extension

is seen that they are a reaction to injury The sequence of events is thought to be hemorrhage, followed by a connective-tissue and blood vessel proliferation, with the appearance of giant cells Calcification or bone formation may occur Any stage in the process may be followed by resolution

1 Hemorrhage is followed by a fibroendothelial response associated with an increase in the number and size of blood vessels Evidence of this

previous hemorrhage is demonstrated by the presence of red blood cells and/or pigment in the majority of the lesions. These findings are occasionally absent in the more fibrous form of the lesion



FIG 21 5 (*Upper left*)—Peripheral giant-cell reparative granuloma appearing as a fibrous polypoid tumor mass on the buccal surface of the gingiva. Roentgenographic evidence of bone invasion was absent.

FIG 21 6 (*Upper right*)—Peripheral giant-cell reparative granuloma appearing as a localized hypertrophy of normal-appearing gingival tissues, although the crowns of the teeth have been separated and roentgenograms showed an early invasion of alveolar bone.

FIG 21 7 (*Lower left*)—Recurrent peripheral giant-cell reparative granuloma following extraction and curettage.

FIG 21 8 (*Lower right*)—Peripheral giant-cell reparative granuloma with extension involving the alveoli of three incisive teeth.

2. The giant-cell reaction is probably a response to hemorrhage but the exact origin of the giant cells has not been conclusively determined. There is little evidence that they are osteoclasts
3. The stroma, unlike the stromal cells of a true giant-cell tumor is a simple connective-tissue reparative response

4 A connective-tissue zone is characteristically present around the reparative reaction This pseudocapsule appears to surround the process, and as the lesion matures it may increase in density and compress the reparative reaction, with eventual disappearance of the lesion
5 Phagocytosis of the red blood cells occurs, and blood pigments frequently remain at the site As this reaction subsides, the productive fibrosis becomes more obvious
6 Calcification of a nonspecific character, new bone, or, rarely, cementum is present in approximately half these lesions
7 At any stage of its process the giant-cell reparative granuloma may undergo resolution, with dense fibrous tissue interspersed with bone, cementum, or foci of calcification

Clinical Characteristics

The Peripheral Giant-cell Reparative Granuloma This growth usually presents itself as a polypoid-shaped or even as a broad-based lesion along the alveolar crest, usually in front of the first molar teeth, although such lesions may occur in relation to the molar teeth The majority of lesions present on the external surface of the gingival crest, however, portions may extend through and appear lingually The lesion may be firm and slightly cyanotic, usually nonulcerated, with its base attached to the free margin of the gingiva and the neck of the adjacent tooth Other lesions may appear much firmer and have a fibrotic appearance

The Central, or Intraosseous, Giant-cell Reparative Granuloma This lesion may be entirely symptomless and may be recognized only on roentgenographic examination Early symptoms are a mild toothache, soreness or aching in the jaw bone, or a loosened tooth As the process advances, the cortex is thinned and the bony surface expands The sites are more commonly related to the anterior teeth but may appear elsewhere in the jaw

Roentgenographic Appearance

The peripheral type invariably has a greater or lesser degree of bone destruction, which may be overlooked unless films are taken from various angles Certain lesions are definitely more aggressive in their destruction of alveolar bone than others The invasive margins are lacelike, from direct invasion rather than from pressure resorption

The *central, or intraosseous*, giant-cell reparative granuloma produces a unilocular radiolucent zone which may be round or oval when related to teeth In rare instances, when located in the angle of the jaws or away from tooth roots, it may have the characteristic scalloping effect of a multilocular lesion The more common locations are in the odontic regions and produce the roentgenographic appearance of a tumor process



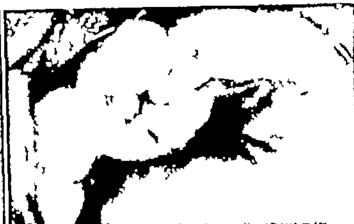


FIG. 21-9 (*Left*)—Peripheral giant-cell reparative granuloma arising on a broad base from the lingual surface of the gingiva. Roentgenographic evidence of bone involvement was not demonstrated.

FIG. 21-10 (*Right*)—Peripheral giant-cell reparative granuloma with equal growth labially and lingually as well as with a separation of the crowns of the lateral and cuspid teeth.





FIG. 21-11 (*Left*)—Peripheral giant-cell reparative granuloma which has destroyed the alveolar bone between the central incisor and lateral incisors and the entire lamina dura of the central incisor.

FIG. 21-12 (*Right*)—Peripheral giant-cell reparative granuloma with destruction of alveolar bone and root resorption of mesial aspect of a nonvital bicuspid tooth.

rather than of a cyst It has a characteristic radiolucent zone, with the tooth roots projecting into the involved area, a destruction of the lamina dura, and an ill-defined invasive peripheral margin

Diagnosis

The *peripheral giant-cell* reparative granuloma may have a classic appearance, but the majority of these growths are altered by chronic irritation trauma, and inflammation It may simulate an early carcinoma of the gingiva, as well as benign conditions such as pyogenic granuloma, pregnancy tumor fibroma, or a fibroepithelial papilloma

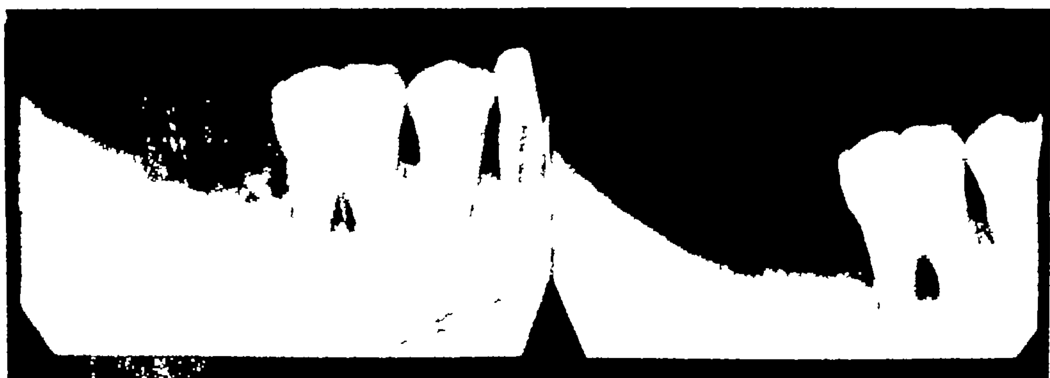


FIG 21 13—Peripheral giant-cell reparative granuloma in the molar area showing invasion of alveolar bone The extraosseous portion of the tumor is revealed by the presence of bone spicules

The *central giant-cell* reparative granuloma may usually be distinguished roentgenographically from cysts, but it may simulate carcinoma of the gingiva ameloblastoma, and other space-occupying lesions of the jaws

The histologic diagnosis for both these types of granuloma is readily accomplished by prompt biopsy Hyperparathyroidism may be excluded by a complete physical examination, determination of serum, calcium and phosphorus levels and if indicated, a roentgenographic skeletal survey A definite diagnosis, including identification of systemic factors, must be established before curative therapy is instituted

Treatment

The peripheral form of giant-cell reparative granuloma, with only slight roentgen evidence of bone involvement, may be removed locally Care must be taken to include bone involved and to effect complete removal of the attachment to the neck of the tooth Those with considerable alveolar bone invasion, and all central tumors, may be treated by the extraction of the involved tooth or teeth and thorough curettage



FIG 21 14—Peripheral giant-cell reparative granuloma which has destroyed the alveolar ridge from the midline to the first bicuspid

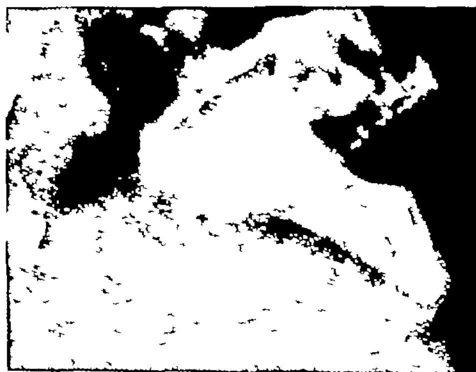


FIG 21 15—Peripheral giant-cell reparative granuloma with extensive alveolar and cortical bone destruction.



FIG. 21 16 (*Upper*)—Peripheral giant-cell reparative granuloma with ulceration due to carcinomatous change

FIG. 21 17 (*Lower*)—Same patient as in Fig 21 16 Alveolar bone has been destroyed in the bicuspid area Pathologic examination established that this destruction was due to the giant-cell tumor rather than to carcinoma

Since these granulomas are quite radiosensitive irradiation by means of local roentgen therapy or insertion of radon seeds is successful as an adjunct to the surgery or in certain cases as the primary treatment The radiation dosage required is not more than one third the lethal dose for carcinoma of a similar size and position and this amount of radiation leaves no postradiation sensitivity abnormal scar or injury to the para dental or tooth structures



FIG 21 18 (*Left*)—Central giant-cell reparative granuloma which probably arose in the alveolus of the second bicuspid tooth A large radiolucent area occupies the central half of the mandible Roots of the bicuspid and molar teeth lie within the tumor The margin of the radiolucent zone is fairly well demar cated, and a thin rim of cortical bone remains along the inferior border of the mandible.

FIG. 21 19 (*Right*)—Same patient as in Fig 21 18 one year after roentgen therapy New bone formation is shown by decrease in radiolucency

HYPERPARATHYROIDISM

Hyperparathyroidism is due to a hypersecretion of parathormone from the parathyroid glands. It is characteristically seen with an enlargement of one or more of the parathyroid glands, deossification of the skeleton, and some form of renal lesion The disease may be divided into two types the primary (osteitis fibrosa cystica generalisata) and secondary (renal rickets) The osseous changes are similar in both types but the changes in the parathyroids and the kidneys differ in the two types and are therefore discussed separately

Jaw and more rarely gingival manifestations are noted in the majority



FIG 21 20 (*Upper*)—Peripheral giant-cell reparative granuloma recurrent in a six-year-old child following extraction of three deciduous teeth

FIG 21 21 (*Lower*)—Same patient as in Fig 21 20, nine years after radiation therapy by a combination of roentgen rays and radon seeds The permanent teeth were not damaged, although eruption to full function was delayed

of patients This disease is important among the large number of systemic conditions which manifest diagnostic oral lesions

Applied Anatomy

In both types of hyperparathyroidism the parathyroid glands are affected Normally there are four glands approximately 5 mm in diam

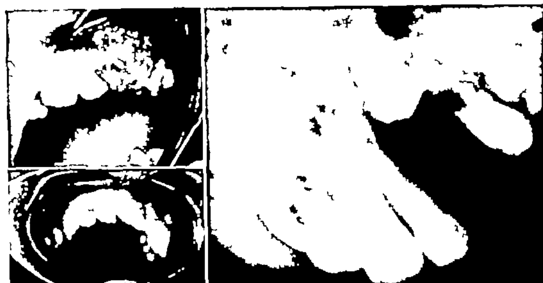


FIG 21 22 (*Upper left*)—Peripheral giant-cell reparative granuloma in the cuspid and deciduous first molar area. These teeth were spontaneously extruded, and the tumor developed in the alveoli as a reddish, rather soft mass

FIG 21 23 (*Right*)—Same patient as in Fig 21 22. Destruction of bone around the erupting first bicuspid is seen

FIG 21 24 (*Lower left*)—Same patient as in Figs 21 22 and 21 23 ten years after roentgen therapy Full eruption of permanent teeth and only minor malocclusion are demonstrated

eter a superior and inferior one on each side usually in intimate relation with the posterior aspect of the thyroid. The superior is more constant in location than the inferior

The normal glands are yellow to yellow brown in color smooth and flattened with well-defined, sharp margins and each has a small vascular pedicle. Microscopically the glands in adults normally contain a large amount of fat. Basically they are composed of two types of cells chief cells and pale oxyphil cells (involuted chief cells) The chief or principal, cell is altered in primary hyperplasia and hypertrophy whereas in secondary hyperparathyroidism increased numbers of pale oxyphil cells are present.



FIG 21 25 (*Upper*)—Central giant-cell reparative granuloma with bone d[illegible]struction and displacement of teeth

FIG. 21 26 (*Lower*)—Same patient as in Fig 21 25, following extraction o[illegible] central and lateral incisors and deciduous cuspid teeth Residual tumor mas[illegible] occupies the entire edentulous alveolar space



FIG 21 27 (*Left*)—Same patient as in Figs 21 25 and 21 26 showing extensive destruction, including two-thirds of the hard palate as well as anterior alveolar bone.

FIG 21 28 (*Right*)—Same patient as in Figs 21 25 21 26 and 21 27 one year after roentgen therapy including implantation of radon seeds showing bone regeneration throughout the involved area

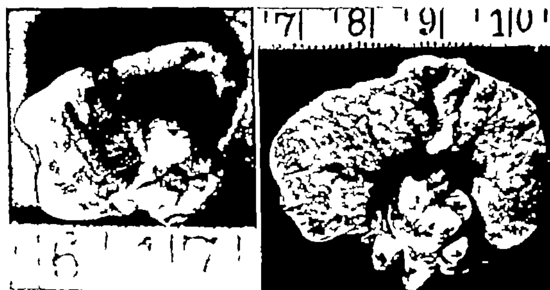


FIG 21 29 (*Left*)—Peripheral giant-cell reparative granuloma adherent to a molar tooth at the cervical line.

FIG 21 30 (*Right*)—Peripheral giant-cell reparative granuloma which partially enveloped crown and was adherent to the roots of a molar tooth

Incidence

Primary hyperparathyroidism is a far more frequent disease than reports in the literature would indicate Prior to 1951 approximately 600 cases had been reported which suggests that only a small proportion of the existing cases were diagnosed This conclusion is given further support by a more recent report that 3 to 10 per cent of all cases of urolithiasis, a relatively common entity, were found to be due to hyperparathyroidism

Etiology

Primary hyperparathyroidism is an endocrine dysfunction which is caused by any one of several pathologic states In order of frequency these causes are a single adenoma, primary hyperplasia, and, in a small number of cases, multiple adenomas or carcinoma of the parathyroid gland The cause of primary hyperplasia is not known

Secondary hyperparathyroidism has long been referred to as renal rickets It is due to a long-standing renal lesion causing retention of phosphates, with acidosis, which results in multiple parathyroid gland enlargement

Pathology

Primary Hyperparathyroidism Most commonly there is a single adenoma which characteristically is markedly enlarged, light brown soft and smooth Microscopically, the adenoma is composed predominantly of large chief cells Hyperfunction correlates roughly with the size of the tumor Multiple adenomas are uncommon

Primary hyperplasia is characterized by a diffuse but unequal enlargement of all the glands Those situated superiorly are usually larger than those situated inferiorly The enlarged glands are soft, dark-mahogany-brown in color, and irregular in shape, and they have a definite capsule Microscopically the normal parathyroid tissue is replaced by a single cell type the cytoplasm of which is clear (wasserhelle) Carcinoma of the parathyroids is rare, and the diagnosis may be made at surgery if the enlarged gland is adherent to adjacent structures After the tissue has been submitted to a pathologist the final diagnosis is based on the findings of capsular invasion and/or metastases to the regional lymph nodes

The renal changes seen in the patients with adenomas and primary hyperplasia are similar and are the result of—not the cause of—the enlargement of the parathyroids The changes are not pathognomonic for these two conditions are seen almost always where there is an in

creased amount of calcium excreted by the kidneys over a long period of time The condition is known as parenchymal nephrocalcinosis and the characteristic changes are in the distal convoluted tubules. Here the nuclei of the tubules become calcified spreading into the cytoplasm and ultimately resulting in desquamation of the involved cells into the lumen as a calciferous cast. As a rule an inflammatory reaction is not present.

Secondary Hyperparathyroidism This disease is associated with unequal enlargement of the parathyroid glands due to some form of genitourinary disease Macroscopically the glands are firm and cream gray in color Microscopically they are circumscribed, but not encapsulated with uniform normal size chief cells and numerous oxyphil cells

The urinary tract disease must be sufficient to cause a long standing renal functional impairment. There is a glomerular as well as a tubular insufficiency which results in an alteration of the chemical anatomy of the intracellular fluids These changes reflect the inability of the tubules to form an acid urine as well as to clear phosphates, urea, creatinine etc. and the inability of the glomeruli to filter phosphorus properly The demand for calcium as a base causes in time a lowering of the serum calcium level, which in turn stimulates the parathyroids The parathyroids secrete parathormone which would ordinarily cause a lowering of the phosphorus level in the serum, but such a lowering is not allowed to take place because of the poor glomerular function Thus there exists a plasma electrolyte defect consisting of a high serum phosphorus level and a low calcium level Th s situation is just the reverse of that seen in adenomas and primary hyperplasia.

Osseous Lesions Indistinguishable in the two types of hyperparathyroidism these lesions vary with the progress of the disease Resorption occurs most rapidly in the most labile bone at the sites of rapid physiologic growth, in the alveolar processes and in spongy bone while in the cortex the resorption occurs more slowly by enlargement of the Haversian canals and thinning of cortical bone. The bone marrow undergoes fibrosis but hemorrhage and its sequelae result in the so-called brown tumor and/or giant cell reparative granuloma. A cyst may develop in the central area of the larger lesions The lamina dura of all teeth is destroyed and gingival ulceration is a frequent complication in areas adjacent to alveolar lesions

The microscopic changes in the skeletal lesions of hyperparathyroidism are not pathognomonic. The earliest histologic change is manifested by an increased number of osteoclasts and bone replacement by connective tissue The resorption occurs in the cortex, marrow and spongy bone. Extensive modification of the internal bony architecture follows The

original osseous structure is replaced by young connective tissue and numerous spindle-shaped cells. Only occasional bone trabeculae may remain. Scattered throughout the stroma are variable numbers of multinucleated giant cells, hemosiderin-laden macrophages, and in some instances cyst formation. These microscopic changes are indistinguishable from those of other unrelated giant-cell reparative granulomas. Following the removal of the involved parathyroid gland or glands, a formation of new bone trabeculae occurs, with a gradual decrease in number of giant cells and a general regression of the reparative granulomas until they partially or completely disappear.

Laboratory Findings. They are significant in the differentiation of primary and secondary hyperparathyroidism as well as this disease when compared with other osseous conditions. In primary hyperparathyroidism the serum calcium level is elevated, varying from 12 to as high as 24 mg per 100 cc. The serum phosphorus level is decreased to 1 to 1.5 mg per 100 cc. The serum alkaline phosphatase level is elevated from 12 to 20 Bodansky units, which denotes the degree of osteoblastic activity. These biochemical data as a group are characteristic of primary hyperparathyroidism: hypercalcemia, hypophosphatemia, hypercalcinuria, and an increase in amount of alkaline phosphatase.

In secondary hyperparathyroidism the reverse situation is found. The serum calcium level is low, and the serum phosphorus level is high.

Clinical Characteristics

Osseous Symptoms. Characteristically prominent in both forms of this disease, the osseous symptoms are due to a softening of the bone. Either deformity, particularly of the lower extremities, or spontaneous pathologic fracture is not uncommonly the first complaint. Occasionally a mild intermittent pain resembling rheumatoid arthritis is experienced. Patients with prolonged, untreated cases sustain multiple spontaneous fractures and increased skeletal deformities.

Lesions of the jaws, other than the resorption of the lamina dura, and diffuse osteoporosis are uncommon but when present are either peripheral or central giant-cell reparative granulomas. The peripheral type is a tumorlike mass on the alveolar crest, whereas the central type is a bone-destructive lesion causing an expansile process, with elevation and loosening of the involved teeth, which produces malocclusion.

Extraosseous Complaints. They commonly follow but rarely precede osseous complaints. Symptoms include fatigue, muscular weakness, anorexia, nausea, vomiting, and abdominal cramps. Urinary complaints are more common in the secondary type of hyperparathyroidism. Hematuria and renal colic are due to the common presence of renal calculi. Routine roentgen studies of the kidney region are advisable.

Roentgenographic Appearance

Early osseous lesions rarely show evidence of alteration in bone structure This is particularly true today when diagnoses are being made in an earlier stage of this disease. The initial sign is a deossification that causes granular miliary mottling and is characteristically seen in the skull flat bones and phalanges. In the jaws the osseous pattern becomes more coarse and the trabeculae are less distinct while the cortex becomes gradually thinned. The process advances to a cystlike lesion with ill-defined and nonsclerosing margins which gives the appearance of a multilocular radiolucent area.

The most characteristic roentgenographic feature in the jaws is the absence of the lamina dura. Since the structure of the teeth is not affected and the bone is porotic, they appear more prominent in the roentgenogram Normally this density differential may be compared with the osteomalacia type of bone-tooth relationship

Diagnosis

Hyperparathyroidism should always be considered in the clinical differential diagnosis for all peripheral tumorlike lesions of the gingiva and for all central radiolucent areas in the jaws The disease is particularly suggestive in those cases with multiple peripheral giant-cell reparative granulomas

Certain osseous lesions such as monostotic and polyostotic fibrous dysplasia osteitis deformans, carcinoma with widespread skeletal metastases and central giant-cell tumors may simulate hyperparathyroidism but are differentiated by laboratory and microscopic findings

Biopsy is necessary to make a diagnosis If the giant-cell reparative granuloma is reported, a bone survey appropriate laboratory studies and examinations of the parathyroid area are indicated especially in adults.

Treatment

With significant clinical, laboratory and roentgen findings a palpable nodule in the thyroid region is confirmatory evidence of hyperparathyroidism An exploration should be made of the parathyroids and one or more of the offending glands should be removed. Prompt relief of the symptoms and reossification of involved bone areas will usually follow with a prompt return of normal blood chemistry Large peripheral and central lesions may not completely disappear however and in rare instances surgical removal or exposure and curettage with insertion of bone chips may be necessary

READING REFERENCES

ALBRIGHT, F, and E C REIFENSTEIN, JR *The Parathyroid Glands and Metabolic Bone Diseases* The Williams & Wilkins Company, Baltimore, 1948

BERNIER, J L, and L R CAHN "The peripheral giant-cell reparative granuloma," *J Am Dent Assoc* 49 141–148 (1954)

BLACK, B K, and L V ACKERMAN "Tumors of the parathyroid, a review of 23 cases," *Cancer* 3 415–444 (1950)

CAHN, L "The jaws in generalized skeletal disease," *Ann Roy Coll Surgeons, England* 8 115–140 (1951)

CASTLEMAN B *Atlas of Tumor Pathology Tumors of the Parathyroid Glands*, Section IV, Fascicle 15 Armed Forces Institute of Pathology, Washington, D C, 1952

FOGH-ANDERSEN, P "Adenomata of the parathyroid glands 12 cases treated surgically," *Acta Chir Scand* 107(4) 321–334 (1954)

JAFFE, H L "Giant-cell reparative granuloma, traumatic bone cysts, and fibrous (fibro-osseous) dysplasia of the jawbones," *Oral Surg Oral Med. Oral Pathol* 6 159–175 (1953)

SCHNEIDER, W "Hyperparathyroidism (generalized osteitis fibrosa)," *Oral Surg Oral Med Oral Pathol* 6·745–755 (1953).

WEINMANN, J P, and H SICHER *Bone and Bones Fundamentals of Bone Biology* The C V Mosby Company, St Louis, 1947

CHAPTER 22

Other Diseases of Bone Simulating Tumor

THE HISTIOCYTOSES

The histiocytoses are clinicopathologic entities including eosinophilic granuloma, Hand Schüller Christian disease and Letterer Siwe disease While the evolution of these various conditions is not known, it is currently thought that they are all related and that the pathologic unit of the triad is eosinophilic granuloma. According to this point of view the disease may remain as such or may gradually become transformed into Hand Schüller Christian or more rarely Letterer Siwe disease. This concept, however is not uniformly accepted, and further study of documented cases will be necessary before the pathogenesis is clarified The diseases are discussed separately because of their varied clinical course and prognosis

EOSINOPHILIC GRANULOMA

Eosinophilic granuloma may have a short or long clinical course and may at any time develop into Hand Schüller Christian disease or possibly Letterer Siwe disease

Incidence

It occurs from infancy to old age, with approximately two-thirds of the patients in the second and third decades Males predominate 5 1 over females

Etiology

The etiology is unknown, although infection trauma neoplasia, and metabolic disturbances have all been proposed as inciting factors

Pathology

Eosinophilic granuloma is characteristically monostotic, but it may be polyostotic to such an extent that at least 25 bones may be involved

Any bone in the skeleton can be affected More commonly involved are the cranium, ribs, femur, tibia, pelvis, humerus, mandible, maxilla, and rarely the hands and feet In children the most frequent site of involvement is the skull, and in such cases the jaws are commonly affected This disease is considered to be confined to bone

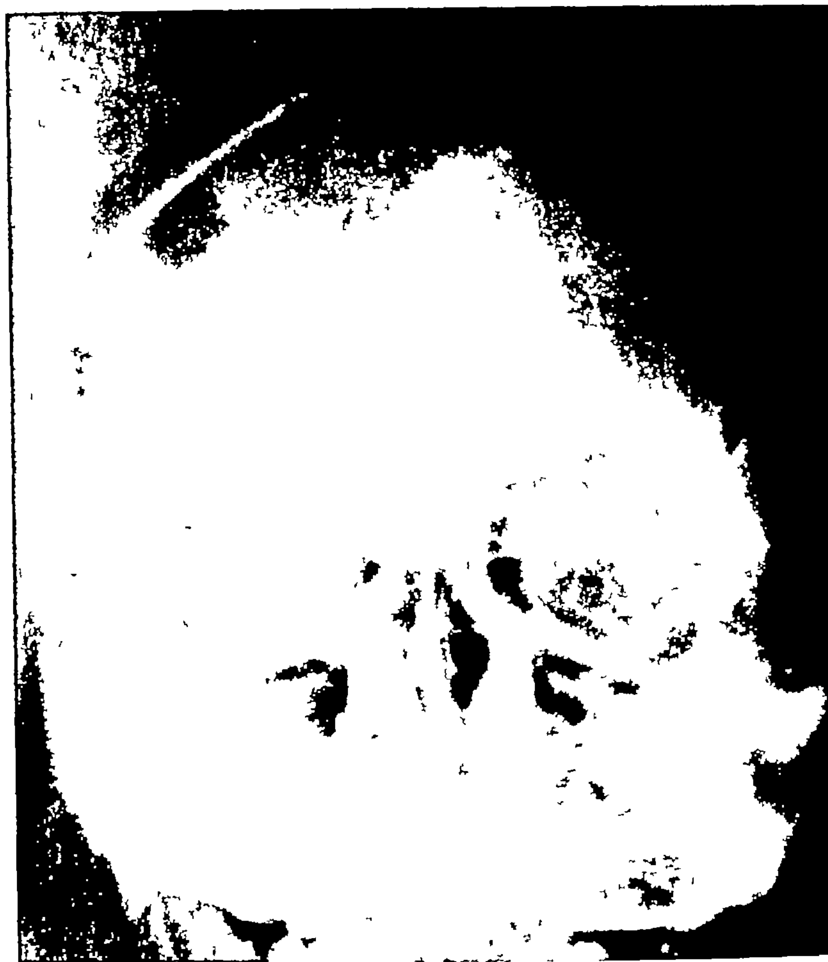


FIG 22 1—Eosinophilic granuloma with distinctive marginated defects in the calvarium The moderate osteosclerotic reaction in the frontal area indicates the relatively long duration of the disease

On gross examination the tissue is seen to be friable and brownish yellow in color Microscopically the characteristic cell is a histiocyte with a reniform nucleus and an abundant eosinophilic cytoplasm The histiocytes frequently have lipids in their cytoplasm In addition, numerous collections of eosinophilic cells (somewhat smaller than those in circulating blood) and a variable number of multinucleated giant cells are present In the resolution of the process, ossifying granulation tissue gradually occurs with healing of the bony defect.

Clinical Characteristics

The initial symptom as a rule is tenderness of the soft tissues overlying the lesion, without signs of local inflammation. Usually a constant aching pain supervenes with swelling of the soft tissues muscular spasm, and atrophy When the jaws are involved, sore mouth, unpleasant taste sore and swollen gingivae and loose teeth may be observed After extrac-



FIG 22 2—Same case as in Fig. 22 1 with multiple, well-demarcated, and punched-out lesions of various sizes

tions the sockets not infrequently fail to heal. Constitutional symptoms such as slight fever anorexia, fatigability headache and weight loss may be present The blood studies are not characteristic except that in some cases a mild eosinophilia is present.

Roentgenographic Appearance

The skeletal lesions are purely osteolytic, may be central or cortical and may erode or expand the cortex. The defects are round or irregularly shaped radiolucent areas sharply demarcated from adjacent normal bone. Periosteal overgrowth may be present, and pathologic fractures are not uncommon The jaws may have similar sharply defined punched

out radiolucent areas as seen in long bones, although a marked resorption of the alveolar bone is noted around the teeth This produces the effect of teeth floating in space without bony attachment beneath Exfoliation occurs frequently, or loosened teeth are extracted for what might appear to be an infection Both solitary and multiple lesions are common in the mandible and occur more rarely in the maxilla

Diagnosis

Eosinophilic granuloma may simulate, clinically or roentgenographically or in both ways, many other conditions which sometimes occur in the jaws, particularly Ewing's sarcoma, myeloma, osteomyelitis, benign cysts, giant-cell reparative granuloma, ameloblastoma, and metastatic carcinoma The final diagnosis can be made only by biopsy

Treatment

Once a diagnosis is established, curettage or roentgen therapy, or both, is sufficient.

Prognosis

Eosinophilic granuloma usually heals completely with proper treatment, but the prognosis must be guarded, since there is a possibility of a transformation into one of the other more serious histiocytoses

HAND-SCHULLER-CHRISTIAN DISEASE

This disease, formerly classified as a lipoid storage disease, xanthomatosis of bone, etc , is now considered by many to be one of the triad of the histiocytoses

Incidence

Children are most often affected, usually between the ages of five and ten years.

Pathology

The disease has a predilection for bones, particularly the base and vault of the skull and the orbital fissures The skull lesions are of random occurrence and are not specific features of this disease The jaws are characteristically affected early The original bone lesions are considered by many to resemble those of eosinophilic granuloma With progress of the disease the histiocytes become fat-laden, fibroblasts proliferate, and scarring results This lipogranulomatous characteristic must be present before a diagnosis of Hand-Schuller-Christian disease can be made



FIG 22 3 (*Upper*)—Hand Schüller-Christian disease with characteristic osteolytic reaction around the base of the second molar tooth.

FIG 22 4 (*Lower*)—Same case as in Fig 22 3, showing the opposite mandible with polymorphic, sharply marginated defects. Exfoliation of the second molar tooth appears almost complete and to be "floating in air"

Similar lesions may be present in many other tissues, including skin, but particularly in organs where there is reticuloendothelial tissue, i e, spleen, liver, lymph nodes and lung The fortuitous involvement of the base of the skull accounts for the change in the region of the pituitary and optic tracts These may result in growth disturbances diabetes insipidus, and exophthalmos. The calvarium defects are often referred to by the roentgenologist as *geographic skull*



FIG 22 5—Hand-Schuller-Christian disease with clearly defined radiolucent areas, associated with root resorption Osteosclerosis is not present

Clinical Characteristics

Certain symptoms predominate in the majority of cases. In their order of frequency are exophthalmos, polyuria, polydipsia retardation in growth with dystrophia adiposogenitalia, mental retardation, and cutaneous and oral signs and symptoms The latter complaints are sore gums, loosening, caries, pus exuding from around the teeth, gingival hemorrhages, and premature loss of teeth In addition there may be splenomegaly, hepatomegaly, enlargement of lymph nodes and respiratory complications Dwarfism due to pituitary involvement is rare The clinical course is quite variable It usually extends over a period of years, but exceptions to this are not infrequent during early childhood

Roentgenographic Appearance

Defects are seen most characteristically in the calvarium (geographic skull) in the base and in the jaws The bony radiolucencies are irregular but sharply and distinctly demarcated The bone involvement is greater than the roentgenograms would indicate although these changes are usually minor when compared with the superimposed soft

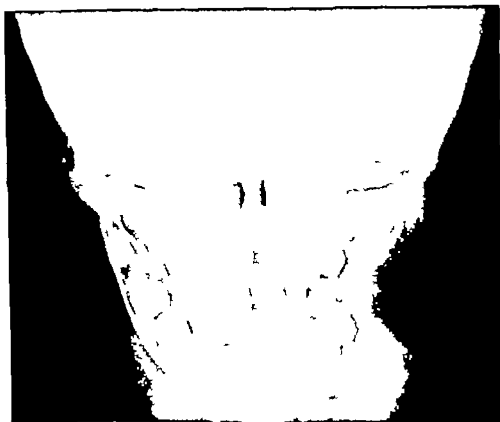


FIG 22 6—Same case as in Fig 22 5 demonstrating extensive destruction of cortical bone and displacement of teeth

tissue swelling In the jaws a varying amount of alveolar bone is destroyed, most characteristically around the apices of the teeth. These radiolucent areas appear like large cysts and the crowns of unerupted or erupted teeth may appear to float in air As a result the teeth are frequently displaced and finally exfoliate.

In adults the jaw defects resemble periapical abscesses or extensive destruction from periodontal disease

Diagnosis

After a complete clinical study a conclusive diagnosis can be made by a histologic study Metastatic neuroblastoma should be considered in children and metastatic carcinoma or multiple myeloma in adults



FIG 22 7—Same case as in Figs 22 5 and 22 6, showing multiple defects in the skull Extensive geographic defect in the frontal and temporal area involves the inner table These lesions in the calvarium are chiefly extradural, but subperiosteal initially Invasion of the inner table seldom produces an osteosclerotic reaction

Treatment

Prompt response of the disease may be expected from general supportive measures and irradiation Roentgen therapy in small repeated doses causes a regression of cystic areas in the jaws, the loosened teeth become solid, and disappearance of the gingivitis and stomatitis is noted However, it must be understood that, while this therapy controls or eliminates the local lesions, it has no lasting effect on the general course of the disease

Prognosis

Therapeutic and spontaneous remissions are temporary only The disease is eventually fatal

LETTERER SIWE DISEASE

This acute, rapidly progressive, and invariably fatal disease always begins under two years of age Signs and symptoms of splenomegaly hepatomegaly ascites, plural effusion secondary anemia, and cutaneous lesions are characteristic. Microscopically the changes in bone are similar to those described for eosinophilic granuloma The microscopic findings in the skin may show only the histiocytic infiltration but there may also be an eosinophilic component. The folic acid antagonists may prolong the patient s life but the disease is ultimately fatal

OSTEITIS DEFORMANS
(*Paget s Disease*)

The clinical description of this unique disease of bone has not been improved on since the time of Paget s original description It is characterized by an insidious onset, chronic course skeletal alterations pathologic fractures elevation in the serum alkaline phosphatase level, and sarcomatous transformation.

Incidence

The relatively common occurrence of osteitis deformans in the jaws is well known. From a collected series of cases approximately one-third shows evidence of involvement in the maxillae with only 1 or 2 per cent affecting the mandible. The latter is almost never affected unless the maxillae are involved

Etiology

matrix are formed As the process continues, the coarse-fiber bone is replaced by lamellar bone, but the edge of the lesion continues to resorb and a cycle is produced which ultimately results in a typical mosaic pattern of osteitis deformans This mosaic pattern is the result of the constant resorption and apposition so that each trabecula contains irregular pieces of bone (breccia) The numerous reversal and resting cement lines separating the breccia give the microscopic mosaic pattern.

Pathology

The gross appearance is that of a thick, irregularly arranged bone replacing the more delicate spongy bone trabeculae The process is most characteristically seen in the long bones, it begins in the metaphyseal regions (upper and lower) and spreads toward the middle of the shaft The cortex is variably thickened by the slow, creeping process, by periosteal new bone as well as by endosteal new bone The periosteal new bone is usually noted only on microscopic examination, except when a fracture has occurred There is then a gross thickening due to periosteal bone formation The medullary cavity of the shaft is usually widened and some areas are filled with trabeculae, joined at random, leaving large cystic spaces The marrow cavity, however, may be partially obliterated, narrowed, and elongated, depending on the stage of the disease In the jaws the initial lesion may be limited to one region only, and later by direct extension it may involve the entire bone As the disease advances, there is an abnormal increase in osteoblastic activity, which produces an excessive amount of sclerotic bone of poor quality and results in enlargement and deformity of the jaws The lamina dura of teeth in the involved regions disappears early Malocclusion and marked displacement of the teeth, with deposition of hyperplastic cementum on their roots, follow This hypercementosis is characteristic of osteitis deformans and serves to differentiate it from hyperparathyroidism and fibrous dysplasia, as well as from other lesions which involve the jaws A further characteristic is the appreciable amount of alveolar bone which remains attached to the roots on extraction

Certain neoplastic processes have been observed to complicate this condition and were even pictured in the initial description by Paget The neoplastic degeneration may be fibrosarcoma, chondrosarcoma, osteosarcoma, or myeloma Osteogenic sarcoma as a complicating disease may appear different from the ordinary primary osteogenic sarcoma These tumors commonly lack the histologic appearance of true bone-forming sarcomas and often do not conform to a single pattern A further difference from the ordinary osteogenic sarcomas is the tendency to develop in several bones, either concurrently or, more often consecutively

Osteogenic sarcoma in patients over fifty years of age is rare without

concomitant osteitis deformans Paget's disease is usually present from ten to fifteen years or more prior to the development of osteogenic sarcoma and such complication is generally believed to be from 5 to 30 per cent.

Clinical Characteristics

The first symptom in the majority of cases is deformity of the maxillae or an increase in the size of the head However swelling of the gingivae



FIG 22 8—Paget's disease showing the classic features of skull involvement a separation and thickening of the tables partial or complete obliteration of the diploë Osteosclerotic islands produce the characteristic cotton-ball appearance The increased density in the base of the skull and the maxillae is also typical.

malocclusion or loosening of teeth is noted initially in some cases. Pain is rarely constant or severe

The onset of the disease is usually insidious and its progress slow without any alteration in the general health of the patient. The disease may be monostotic (affecting one bone) merostotic (affecting a portion of one bone) or polyostotic (involving more than one bone) Except for the membranous bones those most frequently involved are the sacrum lower lumbar and the rest of the spine. The skull is among the

most frequently involved of the remaining bones Usually the cranium is markedly thickened and the suture lines are obliterated but in the early stages radiolucency may be observed in the calvarium, representing the resorptive phase of this disease As the disease progresses, swelling of the jaws causes an increasing difficulty with mastication The teeth in the area become loosened, and invariably extraction is required

The disease progresses with periods of exacerbation and remissions

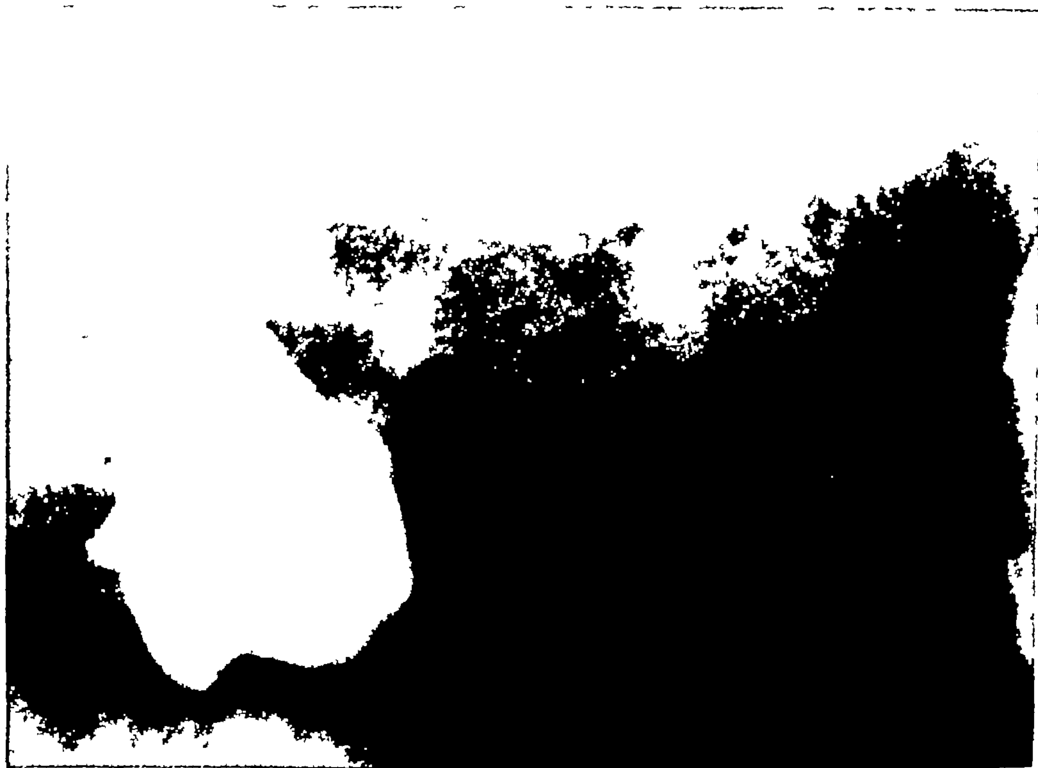


FIG 22 9—Same case as in Fig 22 8, showing in closer detail the osteosclerotic process in maxillary bone

It is usually associated with arteriosclerosis Arteriovenous shunts predispose to congestive heart failure Deafness, blindness, trigeminal neuralgia, and psychiatric complaints may be present because of the thickening of the skull and otosclerosis Pathologic fractures are common

The laboratory finding of a strikingly elevated alkaline phosphatase level is highly suggestive of Paget's disease, but certain neoplastic processes affecting bone may also give such high values The blood calcium and phosphorus levels remain relatively normal

Roentgenographic Appearance

On examination, the bone changes are found to be quite characteristic The affected bone is enlarged, showing cortical thickening and prominence of the individual trabeculae Interspersed within these areas

are zones of radiolucency which may resemble cysts In the skull marked thickenings are observed, together with a coarsely mottled appearance produced by rounded, knoblike areas and increased density in contrast with areas of decreased density This produces the so-called cotton wool appearance.



FIG 22 10—Paget's disease with multiple densities and geographic radiolucencies throughout the calvarium, and diffuse increased density throughout the maxillae

When the jaws are affected, the changes are similar to those seen in the calvarium. In the early resorptive or osteolytic stages the disease has a decreased radiographic density and only part of the maxilla may be involved, with an alteration of the trabecular pattern giving a ground glass appearance. The lamina dura in the involved regions is absent As the disease advances an excessive amount of sclerotic bone develops which results in enlargement and deformity of the jaws Roentgeno-



FIG 22 11—Same case as in Fig 22 10 The sclerotic and cystic defects are relatively confined to the anterior calvarium with separation of the cortices, while the base of the skull and the maxillae show marked sclerosis



Fig 22 12—Same case as in Figs 22 10 and 22 11 demonstrating in detail the osteosclerotic changes in the maxilla which are especially pronounced in the region of the tuberosity

graphic identification of hypercementosis on the roots of the teeth in the involved regions is invaluable in establishing diagnosis

Diagnosis

Diagnosis in the classic case of Paget's disease, with the squared-off head the shortening of the torso, and the bowing of the thighs, is not difficult Likewise, the roentgenographic diagnosis of the more common

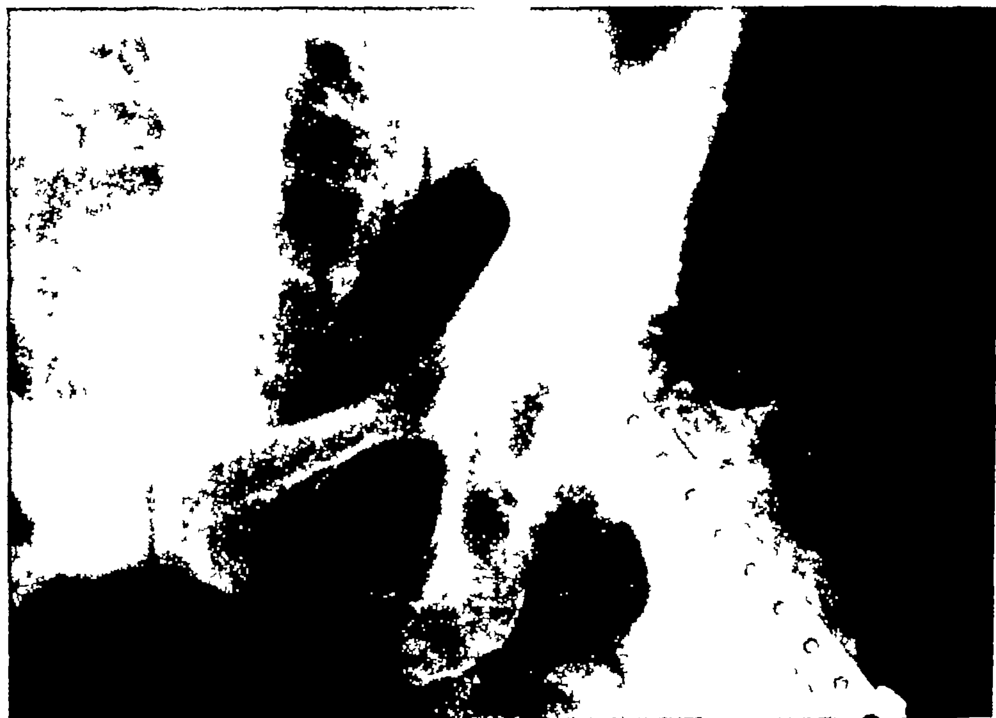


FIG 22 13—Same case as in Figs 22 10, 22 11, and 22 12, with a pathologic fracture through the neck of the femur The coarsened trabeculation of medullary bone and the sclerotic and pseudocystic changes in cortical bone are well demonstrated

polyostotic form is rarely confused with that of other diseases The appearance of early skull lesions may resemble somewhat the appearance of osteitis fibrosa cystica or even bone metastases from carcinoma of the prostate and rarely from other sites of origin A skeletal survey, however, usually establishes a clinical diagnosis In the monostotic form especially when it affects the jaws, a biopsy will be required to establish the diagnosis

Treatment

No specific therapy is curative and the treatment is entirely symptomatic Roentgen therapy is useful for the relief of severe pain



FIG. 22 14 (*Upper*)—Paget's disease causing a pronounced expansile lesion of the alveolar convexity of the palate bone and displacement of teeth

FIG 22 15 (*Lower*)—Same case as in Fig 22 14 showing extensive changes in the maxillae zygomas but minimal involvement of the calvarium



FIG 22 16—Same case as in Figs 22 14 and 22 15, illustrating the diffuse sclerosis of maxillary bone, characteristic clubbing and hypercementosis of the roots of teeth, and almost complete obliteration of the pulp canals



Fig 22 17—Paget's disease has produced a diffuse coarsening of the trabeculae and scattered osteosclerosis. Hypercementosis is most prominent in the molar areas.

FIG 22 18—Paget's disease, with coarse trabeculation in the anterior areas and diffuse sclerosis and cotton-ball effect posteriorly

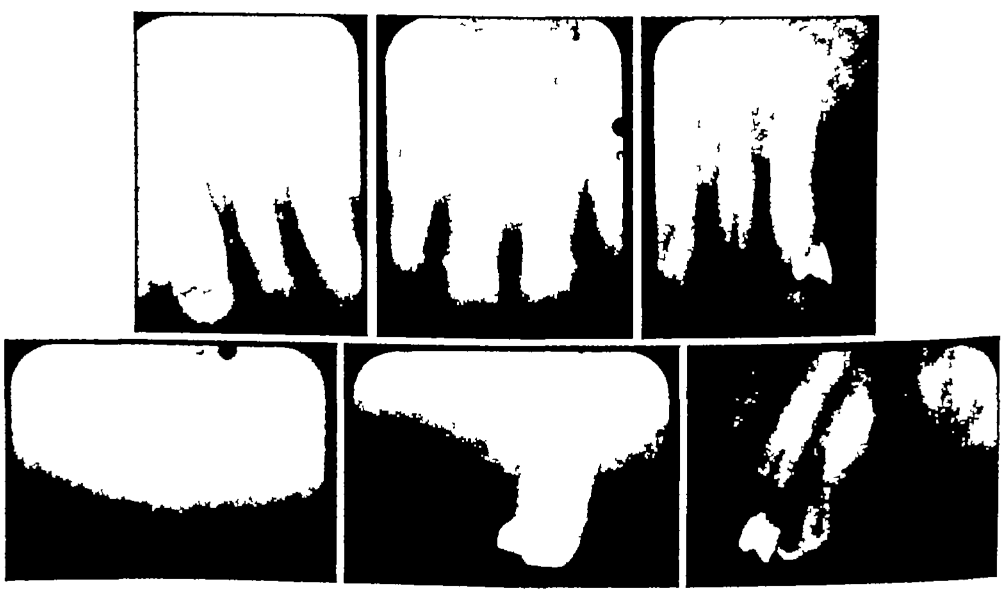


FIG 22 19—Paget's disease demonstrating osteoporotic changes around anterior teeth, advanced hypercementosis, widening, clubbing, and a disappearance of the pulp canals of the posterior teeth

Prognosis

Osteitis deformans in itself may extend over a period of thirty to forty years, and fatalities are due to complications such as arteriosclerosis congestive heart failure pathologic fractures and sarcoma.

INFANTILE CORTICAL HYPEROSTOSIS

This rare self limited disease of cortical and periosteal bone when present, appears at birth or during the first few months of life The most common age period of discovery is between three and six months The disease is manifested by localized tender swellings fever and the in fant s irritability

Etiology

Various etiologic factors such as a refractory type of vitamin-C de ficiency an exceptional sensitivity to vitamin A, or virus infection have been considered and discarded.

Pathology

The disease is most often polyostotic, and the bones affected, in order of frequency are the long bones mandible clavicle, scapula, rib and calvarium Acceleration of osteogenesis is confined to the periosteum and results in a cortical thickening Microscopically the periosteum is seen to be markedly thickened beneath this lies a distinct layer of vary ing densities of new bone The more dense inner layer of bone appears at the location of the original cortex. The middle zone is most probably primary bone while the inner zone is a combination of primary and secondary bone. In either event, the Haversian spaces of the inner zone contain marrow while those in the outer zone contain loose fibrillar tissue There is moderate osteoclastic bone resorption at the interface of the periosteal and middle zones

Clinical Characteristics

Attention may be directed to the infant because of its irritability Localized tender soft part swellings may be noted around the eyes or mandible, as well as over the skull and extremities. Involvement of the mandible usually creates a feeding difficulty On palpation the swellings are found to be tender and there is a deep firmness but no pitting edema or increased local heat A low grade fever may be present and asso- ciated with a leukocytosis of from 10 000 to 25 000 The sedimentation rate and serum phosphatase level are usually elevated.

Roentgenographic Appearance

These lesions in the skeleton are usually multiple but may be monostotic In the long bones the midshaft is conspicuously the site of an asymmetrical lamination of periosteum as well as of cortical thickening The spongiosa, metaphysis, epiphyseal plates, and the centers of ossification in the epiphysis appear to be unaffected In the mandible the process is usually bilateral and appears as an irregular expansion of the body There is increased cortical density, which does not usually involve the alveolar bone



FIG 22 20–Infantile cortical hyperostosis, with evidence of irregular lamellation of the periosteum and moderate cortical thickening of the inferior border

Diagnosis

With typical clinical and roentgenographic findings in the appropriate age group no difficulty in diagnosis is encountered, except in the rare monostotic form where it must be differentiated from malignant bone tumors However scurvy and chronic vitamin-A intoxication must be ruled out, especially in older infants



FIG 22 21 (*Upper*)—Same case as in Fig 22 20 with the typical midshaft periosteal thickening of the right clavicle and the not infrequently associated effusion in the left pleural cavity

FIG 22 22 (*Lower*)—Same case as in Figs. 22 20 and 22 21 with periosteal lamellation and cortical thickening demonstrated best along the medial aspect of the ulna.

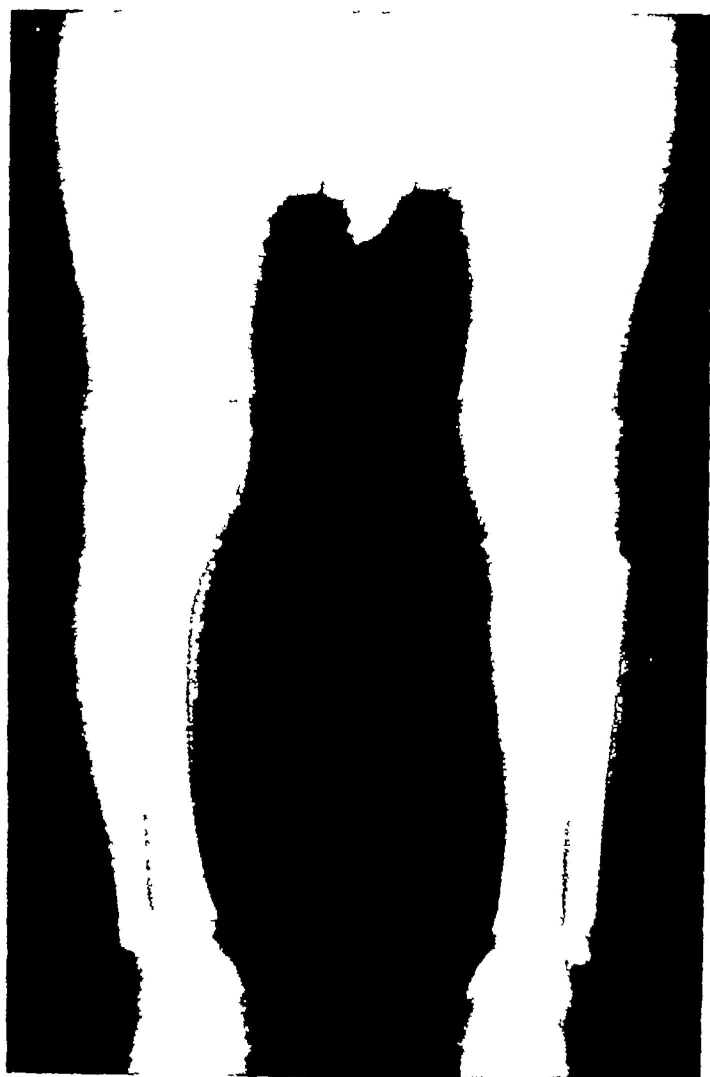


FIG 22 23—Same case as in Figs 22 20, 22 21, and 22 22, with cla
periosteal and cortical asymmetrical thickenings in the middiaphyseal
ments but without involvements of the spongiosa, the metaphyseal extremit
or the epiphyses

Treatment

The disease usually disappears spontaneously during childhood

OSTEOMYELITIS

Osteomyelitis by strict definition includes all inflammatory reactions involving the marrow cavities of osseous structures Inflammation of the periosteum is called periostitis It is infrequently that one of these inflammatory reactions is present without the other at least to some degree and, therefore some prefer to use the term *osteitis* to encompass both forms of the disease Because of the clinical overlap between periostitis and osteomyelitis, the division is purely academic, and the more useful classification of inflammatory diseases of bone is one which divides osteomyelitis into the acute hematogenous variety and the local acute and chronic secondary or primary forms The acute hematogenous variety usually affecting young individuals occurs in the metaphyses of bones and is rarely found in the jaws However the symphysis of the mandible presents an area of predilection for the occasional hematogenous jaw infection The acute local forms of osteomyelitis may arise in any bone and are usually associated with trauma, except in the jaws where acute periapical abscesses and acute pericoronal soft tissue infections are the more frequent causes. In addition the acute local form occasionally arises as an extension of skin infections such as furuncle Acute periodontal infections other than the pericoronal involvements associated with partially erupted teeth seldom produce acute osteomyelitis because of the free drainage usually present in these cases As the acute form of the disease subsides either in response to treatment or because of establishment of spontaneous drainage the process becomes chronic and is classified as chronic secondary osteomyelitis although the dividing line is not sharply established

Chronic secondary osteomyelitis is assumed always to arise first as an acute stage but very often the symptoms of the acute stage remain subclinical and the presenting history would suggest that no acute phase of the disease had previously existed. Chronic secondary osteomyelitis is well demonstrated in the jaws in association with periapical granulomas and, as with other bones infected fractures. Chronic primary osteomyelitis may affect any bone and most frequently is associated with tuberculosis coccidioidomycosis actinomycosis, and syphilis In the jaw however actinomycosis is the most frequent cause.

Histologically acute osteomyelitis is seen as a suppurative process of the marrow cavity with extension toward and elevation of the periosteum. The destruction of both trabecular and cortical bone is primarily

through hyperemic deossification. Chronic osteomyelitis is characterized by an abscess with sequestrum formation, peripheral zones of granulation tissue, and bony sclerosis

Clinically the course of acute osteomyelitis arising in the jaws includes febrile reaction and pain referable to the area of involvement Elevated

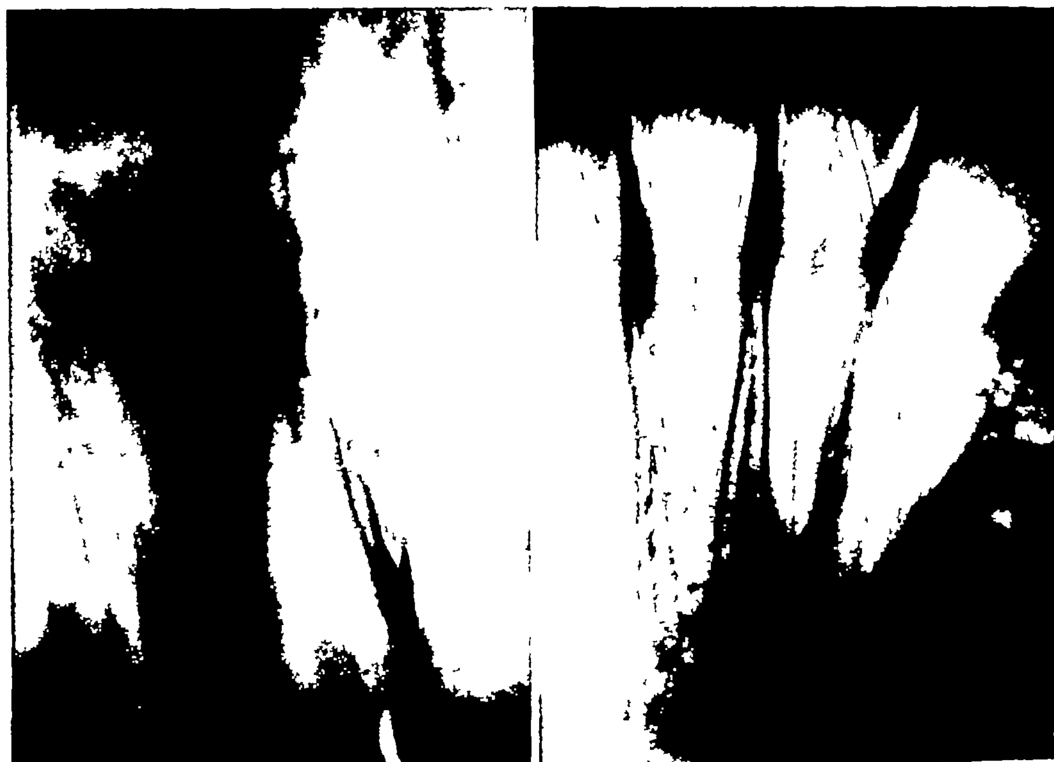


FIG 22·24 (*Left*)—Osteomyelitis complicating an infected periodontal cyst A sclerosed margin persists in some areas, but the irregular erosion and reactive bone formation at the superior lateral margin represent early evidence of osteomyelitis

FIG 22 25 (*Right*)—Chronic osteomyelitis arising in the mandibular cuspid area producing mottled radiolucent defect with indefinite margins Lamina dura of lateral incisor is destroyed, and evidence of erosion of cortical bone overlying the root is seen A broad reactive sclerotic margin is seen in alveolar bone in the cuspid region as is the incompletely isolated area developing sequestrum

white cell counts, as high as 20,000 per cubic millimeter, with a characteristic increase in the neutrophil forms, and temperatures ranging from 102° to 103° F may be part of the typical picture As the process progresses and involves cortical bone, periosteal elevation with stripping occurs and eventually sinus tracts are formed Not all periapical abscesses produce these signs and symptoms, but it must be remembered that such infectious processes are in fact local forms of osteomyelitis Both

the acute and chronic forms arising in the maxilla have a higher tendency to remain relatively localized than in the mandible where the process much more frequently becomes extensive and causes eventual loss of major segments of the bone Chronic osteomyelitis may remain asymptomatic for long periods of time however when periosteal involvement occurs, pain is noticed and soft tissue swelling with sinus tract forma



FIG. 22 26—Chronic osteomyelitis producing destruction of alveolus and body of mandible with involvement of mandibular canal. Margins of the radiolucent defect are indefinite Feathery radiopacity at anterior margin within the defect is suggestive of reactive bone formation

tion usually follows The clinical pathologic picture may include a fluctuating blood count with elevation ranging from 12,000 to 18 000 per cubic millimeter but not rising so high as in the acute form of the disease. The temperature seldom returns to normal and may fluctuate between 99 8 F and 101 F

Roentgenographic evidence of bony changes in acute osteomyelitis is not present for from three to four weeks after the onset of the process The finding of a nonvital tooth frequently leads to definitive treatment without roentgenographic recognition of an osteomyelitis Since the ad vent of antibiotic therapy infected fractures may be managed with chemotherapy and reduction, and the osteomyelitic process frequently resolves without roentgen evidence of infectious destruction of bone

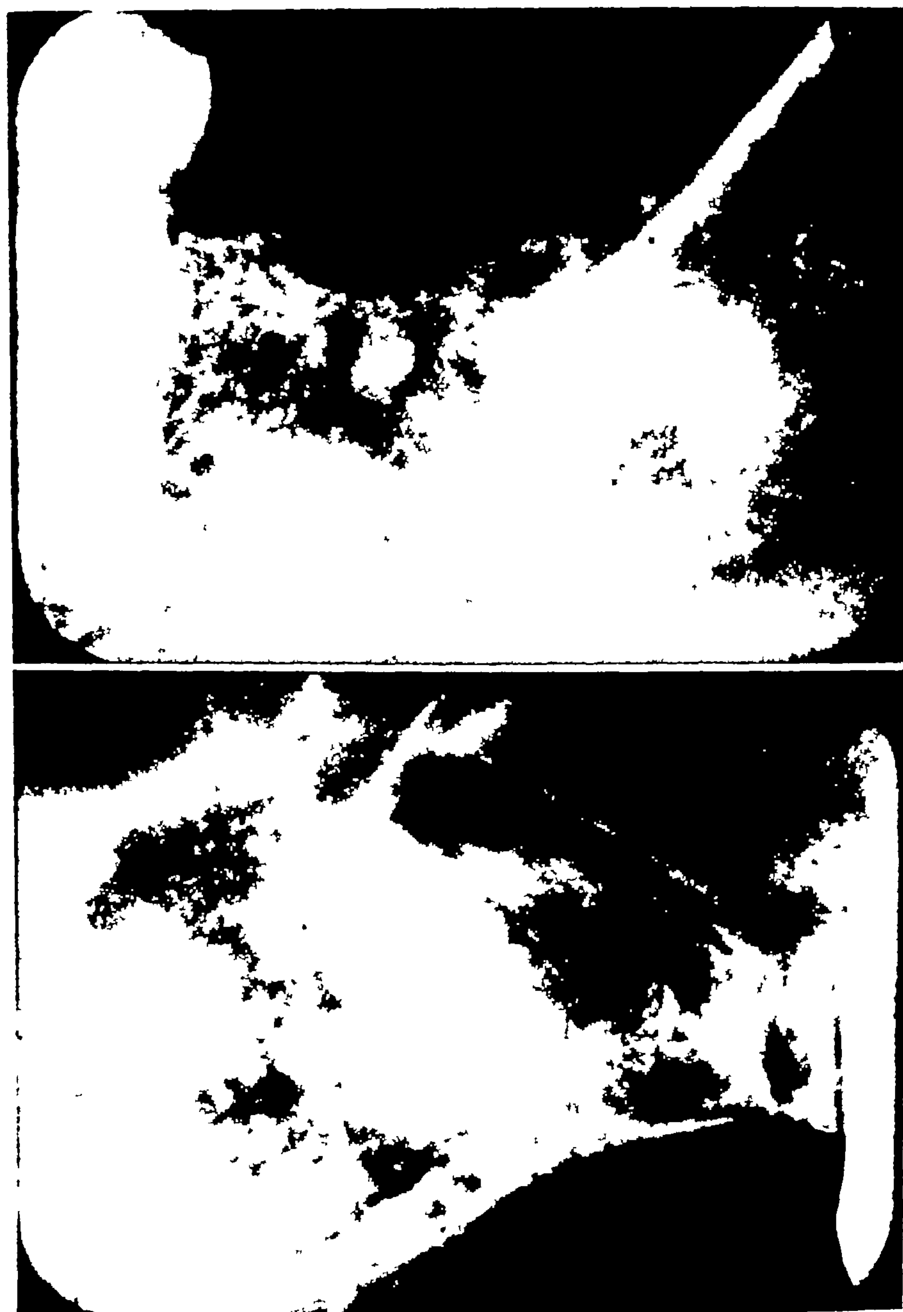


FIG. 22 27 (*Upper*)—Chronic osteomyelitis is residual in the first molar area Superior cortical margin of alveolar process is destroyed A small sequestrum incompletely isolated by radiolucency is seen anteriorly, while sclerotic condensing osteitis is seen posteriorly and inferiorly

FIG. 22 28 (*Lower*)—Chronic osteomyelitis demonstrating heavily sclerosed irregular margins in most areas with a dense midzone of opaque sequestration surrounded by variegated areas of radiolucency and density A metallic foreign body is noted in the midanterior portion

The typical periapical radiolucency commonly seen with acute dental abscesses is of course part of the radiographic picture of osteomyelitis When the infectious and traumatic factors are such as to overwhelm the local resistance the relatively smooth border of the radiolucent zone may become more irregular but roentgen evidence of the bony destruction leading toward sinus tract formation is seldom detected When the acute process reaches the stage of periosteal elevation evidence of the stripping of the periosteum may be seen if a technique for demonstration of soft tissue is used

The appearance of the chronic periodontal granuloma need not be described here However the earliest radiographic change indicating extension of the chronic granuloma is an increasing irregular extension of the spherical form of the radiolucency Occasionally a fortuitous x ray film will demonstrate the course of sinus tracts through the bone toward the surface. Periosteal elevation can be demonstrated peripheral to the sinus tract, and frequently reactive sclerotic bone can be demonstrated three to four weeks after sinus tract formation Long standing involvement usually produces a sequestrum with peripheral sclerosis of surrounding bone, which provides a sharp line of demarcation. Evidence of periosteal elevation and thickening of cortical bone may be the first detectable roentgenographic evidence of chronic osteomyelitis Osteogenic sarcoma Ewing's sarcoma metastatic carcinoma, and the malignant lymphomas may have roentgenographic features indistinguishable from those of the osteomyelitides

Treatment of acute osteomylitis involves the establishment of drainage when the mechanism is one of acute dental abscess and the utilization of antibiotic drugs In the chronic forms similar therapy is frequently necessary The prognosis of both acute and chronic forms of osteomyelitis is good under adequate management with the exception of osteoradionecrosis in which the degree of the defect will depend on the total dosage of radiation The treatment of this latter condition is almost completely one of maintenance of adequate hygiene use of chemotherapeutic agents to control acute exacerbations of disease process and avoidance of operative intervention until spontaneous sequestration occurs.

CONDENSING OSTEITIS

Roentgen evidence of increased bone density of a diffuse nature is frequently seen in the jaws particularly in older individuals In the great majority of cases such increased density must be attributed to sclerosing reaction following low grade subclinical osteomyelitis These low grade infections most typically arise in the jaws in association with periodontal disease. Subsequent to the removal of such diseased teeth, the sclerosed

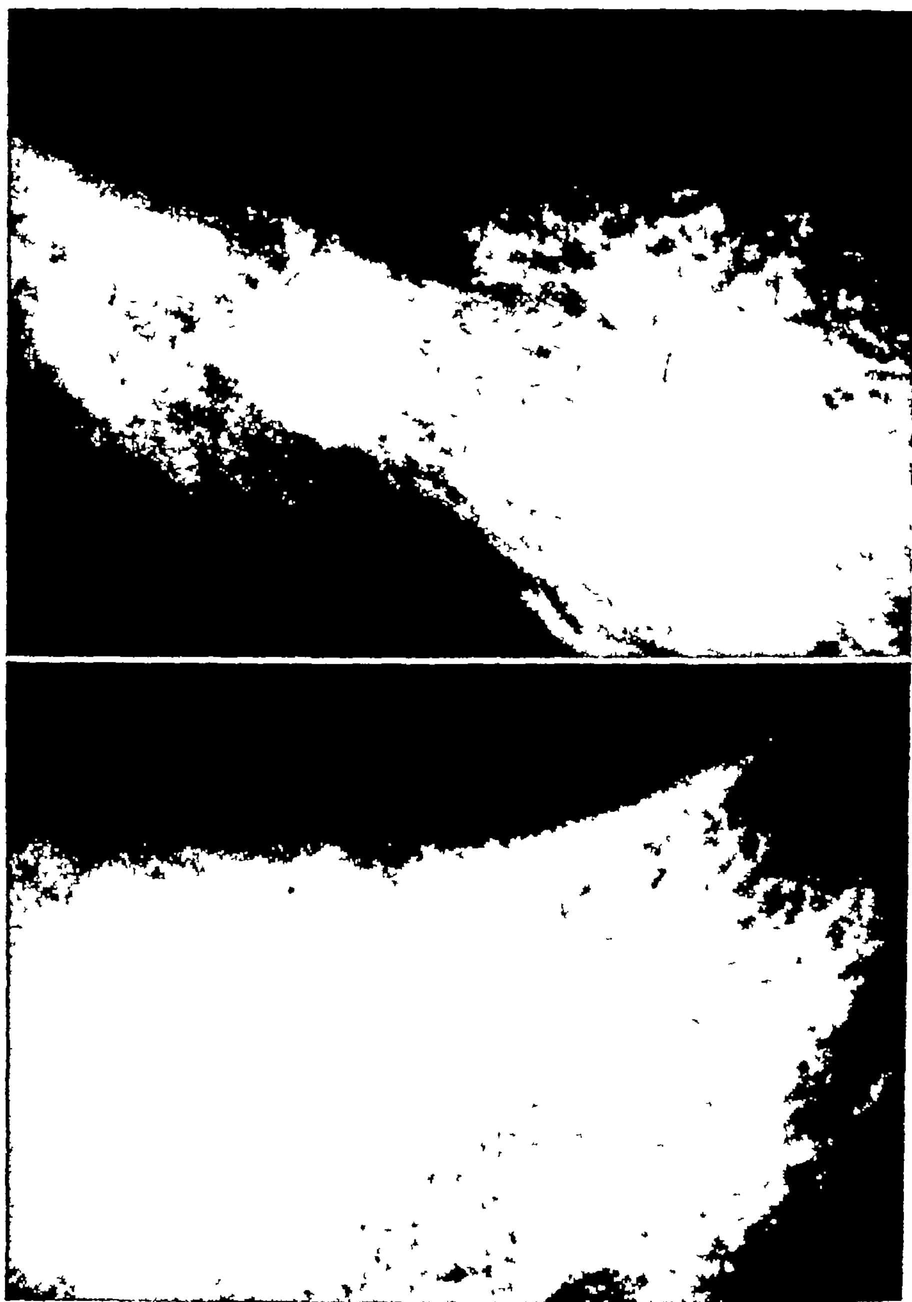


FIG 22 29 (*Upper*)—Condensing osteitis and coincidental periapical fibrous dysplasia residual subapical to a superficial reaction around a retained exfoliating root tip, without evidence of periosteal elevation or reactive bone formation at the superior margin The more posterior area of sclerosis was microscopically compatible with periapical fibrous dysplasia (eburneum stage)

FIG 22 30 (*Lower*)—Diffuse condensing osteitis showing typical lacy extension of reactive bone deposition



FIG. 22 31—Condensing osteitis inferior and posterior to area of alveolar resorption which was the site of chronic periodontal disease The reactive sclerotic margin around central opacity strongly suggests inflammatory process rather than a hamartoma or neoplasm

FIG. 22 32—Diffuse condensing syphilitic osteitis with evidence of periosteal reaction at the interdental cortical margins and the lamina dura The cortical bone appears densely sclerotic, although infrequent areas of mottled radiolucency persist, as is commonly seen following antiluetic therapy

area within the jaw bone is usually persistent, and little change in bone density is detected in roentgenograms in subsequent years Careful clinical and roentgenographic examination is needed when such areas are observed to ensure that no residuum of infection remains in the jaws. When the typical diffuse sclerosis is present without such evidence, treatment is not required

OSTEOPOROSIS

The term *osteoporosis* has a different meaning roentgenographically than it does histologically Histologically, certain specific types are recognized these are generalized conditions usually produced by inhibition of osteoblastic function and defective matrix formation Osteoporosis in the descriptive sense, as used in radiology, refers to the appearance of any form of bone deossification, without regard to the histologic type, and may be either diffuse or focal in distribution The characteristic picture is produced by a decrease in trabeculae, a proportionate increase in the volume of the marrow space, and a deossification or thinning of the cortex This generalized radiolucency is especially well demonstrated in intraoral roentgenograms of the jaws and teeth

Simple bone atrophy is the most common clinical type of osteoporosis and is more often observed in geriatric patients, associated with the postmenopausal state, malnutrition, and disuse atrophy The postmenopausal type arises because of lack of estrogenic stimulation of osteoblasts. Senile osteoporosis is due to a defect in matrix formation because of lack of androgen Malnutrition also has a defective matrix production because of lack of protein (hypoproteinemia) or inability to utilize protein. Disuse atrophy results from decreased osteoblastic stimulation as nonfunction decreases stress and strain on the specific bone involved Idiopathic forms of simple atrophy in the younger age groups are also occasionally seen

Hyperparathyroidism may produce roentgenographic appearances similar to that of simple atrophy Histologically the process is one of osteoclasis and replacement fibrosis Increased circulating parathormone is thought to be the osteoclastic stimulant However, hyperparathyroidism will produce cystic changes and the disappearance of lamina dura around the teeth, distinguishing it from simple atrophy

Hyperthyroidism (thyrotoxicosis) may produce, if untreated or unsuccessfully managed over a period of time a deossification, first in the small flat bones and jaws, later in the spine, and then in the long bones In this disease serum calcium and phosphorus levels remain normal while the calcium excretion rate in urine may be up to eight times normal The decrease in bone density is dependent on (1) the degree of hyperthyroidism (2) the degree of depression of compensating calcium in-

take, (3) the duration of the disease process Roentgenographic changes are not usually detected until this condition has existed for four or five years.

Osteomalacia is a form of decreased bone density arising on a vitamin D-deficiency basis in adults. There is associated with it a decreased



FIG. 22 33—Osteoporosis of alveolar and mandibular bone, almost suggestive of cyst formation, in the edentulous first molar area. The inferior cortical border is less dense than normal.

ability to absorb calcium and phosphorus from the gastrointestinal tract. There is a normal serum calcium level a depressed serum phosphorus level, and an increased phosphorus excretion (tubular resorptive failure in the kidney) Calcification of cartilage and osteoid, however is retarded, permitting the maintenance of normal calcium level in the blood stream. A compensating hyperfunction of the parathyroid glands due to hyperplasia, causes a further increase in phosphorus loss through the kidney mechanism. Adult vitamin D deficiencies are not common and, as a rule the effects of this disease are reversible on adequate vitamin D supplementation although pathologic resorption can proceed to a point where irreversible structural changes are produced.

area within the jaw bone is usually persistent, and little change in bone density is detected in roentgenograms in subsequent years Careful clinical and roentgenographic examination is needed when such areas are observed to ensure that no residuum of infection remains in the jaws When the typical, diffuse sclerosis is present without such evidence, treatment is not required

OSTEOPOROSIS

The term *osteoporosis* has a different meaning roentgenographically than it does histologically Histologically, certain specific types are recognized these are generalized conditions usually produced by inhibition of osteoblastic function and defective matrix formation Osteoporosis in the descriptive sense, as used in radiology, refers to the appearance of any form of bone deossification, without regard to the histologic type, and may be either diffuse or focal in distribution The characteristic picture is produced by a decrease in trabeculae, a proportionate increase in the volume of the marrow space, and a deossification or thinning of the cortex This generalized radiolucency is especially well demonstrated in intraoral roentgenograms of the jaws and teeth

Simple bone atrophy is the most common clinical type of osteoporosis and is more often observed in geriatric patients, associated with the postmenopausal state, malnutrition, and disuse atrophy The postmenopausal type arises because of lack of estrogenic stimulation of osteoblasts Senile osteoporosis is due to a defect in matrix formation because of lack of androgen Malnutrition also has a defective matrix production because of lack of protein (hypoproteinemia) or inability to utilize protein Disuse atrophy results from decreased osteoblastic stimulation as nonfunction decreases stress and strain on the specific bone involved Idiopathic forms of simple atrophy in the younger age groups are also occasionally seen

Hyperparathyroidism may produce roentgenographic appearances similar to that of simple atrophy Histologically the process is one of osteoclasis and replacement fibrosis Increased circulating parathormone is thought to be the osteoclastic stimulant However, hyperparathyroidism will produce cystic changes and the disappearance of lamina dura around the teeth, distinguishing it from simple atrophy

Hyperthyroidism (thyrotoxicosis) may produce, if untreated or unsuccessfully managed over a period of time, a deossification, first in the small flat bones and jaws, later in the spine, and then in the long bones In this disease serum calcium and phosphorus levels remain normal, while the calcium excretion rate in urine may be up to eight times normal The decrease in bone density is dependent on (1) the degree of hyperthyroidism, (2) the degree of depression of compensating calcium in-

take, (3) the duration of the disease process. Roentgenographic changes are not usually detected until this condition has existed for four or five years.

Osteomalacia is a form of decreased bone density arising on a vitamin D-deficiency basis in adults There is associated with it a decreased



FIG 22 33—Osteoporosis of alveolar and mandibular bone, almost suggestive of cyst formation, in the edentulous first molar area. The inferior cortical border is less dense than normal.

ability to absorb calcium and phosphorus from the gastrointestinal tract. There is a normal serum calcium level a depressed serum phosphorus level, and an increased phosphorus excretion (tubular resorptive failure in the kidney) Calcification of cartilage and osteoid however is retarded, permitting the maintenance of normal calcium level in the blood stream A compensating hyperfunction of the parathyroid glands, due to hyperplasia, causes a further increase in phosphorus loss through the kidney mechanism Adult vitamin D deficiencies are not common and as a rule the effects of this disease are reversible on adequate vitamin D supplementation, although pathologic resorption can proceed to a point where irreversible structural changes are produced.

From a roentgenographic point of view, the decreased density of bone seen in association with either hyperparathyroidism or osteomalacia would be termed osteoporosis, or from the histologic point of view, the former would be called the result of overstimulation of osteoclasts, and the latter a failure of calcification of matrix formation because of defective calcium metabolism In intraoral roentgenograms the apparent decrease in trabeculation of alveolar bone can be misleading, for changed angles of film exposure can often produce a considerable distortion of these appearances, likewise, variation in the technique of penetration and exposure of film can produce considerably misleading impressions regarding the generalized bone density when contrasted with the density of the teeth themselves From a diagnostic point of view, bilateral comparison of the segments of the jaw is useful in evaluating the impression of the localized or generalized decrease in bone density, but a specific diagnosis cannot be made without adequate clinicopathologic study

OSTEOPETROSIS

(*Albers-Schonberg Disease*)

Osteopetrosis (osteosclerosis fragilis generalisata) is a rare disease characterized by skeletal and extraskeletal manifestations

Incidence

The manifestations appear equally in both sexes and may be recognized at birth, shortly after, or at any period later in life

Etiology

This interesting hereditary disorder is transmitted as a simple, recessive Mendelian character

Pathology

On gross examination this process is characteristically found in but not limited to bones preformed in cartilage, and is the result of abnormal remodeling sequences leading to the absence of the marrow cavities and to retarded resorption of calcified cartilage, matrix, and spongiosa The bones are extremely dense and hard, therefore sectioning with the saw is difficult The medullary space is filled with the same dense bony tissue that forms the cortex, with obliteration of the marrow spaces While it is difficult to section such a bone with a saw, it is easy, because of its brittleness, to induce a fracture by moderate stress Complete or partial fractures are common

In the metaphyseal regions fractures confined to the spongiosa with-

out involvement of the cortex are common (infractions) The reparative process (callus formation) results in the characteristic transverse radiolucent lines seen roentgenographically

Microscopically the epiphyseal cartilage which normally calcifies and is ultimately replaced by bone remains unresolved for a long time The spicules of calcified cartilage with wide margins of coarse-fiber bone extend down the shaft a considerable distance, obliterating the marrow cavity *Such spicules are scattered at random throughout the bones and* give a false appearance roentgenographically of homogeneous density Because of the abnormal bone formation many skeletal and cranial bones preformed in cartilage have distorted and enlarged contours The foramina are narrowed at the base of the skull

Severe anemia and other hematopoietic manifestations although commonly thought to be due to marrow replacement by the dense bone are apparently *not related to the degree of bone involvement. Dietary* and infectious influences may be of primary importance in the hematological disorder

Clinical Characteristics

The outstanding features of this disease are a high incidence of fractures following trivial injury a severe anemia, hepatosplenomegaly and generalized lymph node enlargement. The alterations of bone around the foramina in the base of the skull cause impingement on cranial nerves resulting in deafness and impairment of vision. The sella turcica may compress the pituitary and cause hypopituitarism

Alterations in bone contour are observed in the jaws even alveolar bone becomes involved and marked malocclusion is an associated finding

Roentgenographic Appearance

The appearances suggest an underexposure of the film The bones show a remarkably dense bony structure in all skeletal parts that are formed in cartilage but usually alternating zones of varying densities are seen.

Diagnosis

This marblelike transformation of the bones seen in roentgenograms is characteristic in itself and may be confused only with that seen in the extremely rare chronic fluoride poisoning

Treatment

No definite treatment is known, but orthopedic and plastic procedures are indicated in the less severe cases

Prognosis

The prognosis is poor, particularly if the condition was present at birth or developed in early infancy Death, however, is usually caused by intercurrent infection or by anemia One case of osteogenic sarcoma of the femur associated with this disease has been reported, and the outcome was fatal

GARGOYLISM
(*Hunter-Hurler Disease*)

Gargoylism is an extremely rare skeletal condition characterized by a facial flattening, particularly of the nose, and a fullness of cheeks, as well as an enlargement of the head The other bones of the skeleton are shortened, and frequently the hands are clawlike in appearance Extra-osseous manifestations are microglossia, corneal clouding, retinitis pigmentosa, deafness, and mental retardation

The cause of gargoylism is not known It has been considered an intracellular deposition of lipids, but more recently the deposits have been identified as glycogen and glycoprotein

This disease occurs predominantly in males and is familial in nature The initial signs and unusual features are present at about the age of three years It has a chronic course In the late stages fatal complications are associated with an atrophic cirrhosis of the liver

The roentgenographic appearances show a characteristic thickening and increased density of long bones, and invariably the acetabular and glenoid fossae are shallow The facial broadening, with flatness of the nasal bones is well demonstrated, and the jaws show the characteristic areas of bone density

READING REFERENCES

BERNIER, J L , and J E ASH *Atlas of Dental and Oral Pathology*, 4th ed. Prepared at the Army Institute of Pathology, Washington, D C , 1948

BRAUSHAW, H A , and B J ORBAN "Oral manifestations of reticulo-endotheliosis," *Oral Surg Oral Med Oral Pathol* 6 869–881 (1953)

CAFFEY, J. "Infantile cortical hyperplasia," *J Pediat* 29 541 (1946)

CAFFEY, J "Gargoylism (Hunter-Hurler disease, dysostosis multiplex, lipochondrodystrophy) prenatal and neonatal bone lesions and their early postnatal evolution," *Bull Hosp Joint Diseases* 12 2 (1951).

COLEY, B L , and G S SHARP "Paget's disease. A predisposing factor to osteogenic sarcoma," *Arch Surg* 23 918–936 (1931)

CONES, D M T "An unusual bone tumor complicating Paget's disease," *J Bone and Joint Surg* 35B:101–105 (1953)

HIGINBOTHAM N L. and S F ALEXANDER "Osteopetrosis four cases in one family" *Am J Surg* 53:444 (1941)

LICHTENSTEIN L. *Bone Tumors* The C V Mosby Company St Louis 1952

MALLORY T B "Medical progress pathology of diseases of bone," *New Engl J Med* 227:955–960 (1942)

MOSSBERGER, J I "Infantile cortical hyperostosis report of a case with observations at autopsy" *Am J Diseases Children* 80:610–620 (1950)

SLEEPER, E. L. "Eosinophilic granuloma of bone its relationship to Hand Schüller-Christian and Letterer Siwe s diseases with emphasis upon oral symptoms and findings" *Oral Surg Oral Med Oral Pathol* 4:896–918 (1951)

SMITH, E. B T C. HEMPELMANN S MOORE, and D P BARR "Gargoylism (dysostosis multiplex) two adult cases with one autopsy" *Ann Internal Med* 36:652–667 (1952)

STAFNE, E. C "Paget s disease involving the maxilla and mandible," *J Oral Surg* 4:114 (1946)

STAFNE, E. C. "Roentgen manifestations of systemic disease in dentistry" *Oral Surg Oral Med Oral Pathol* 6:483–494 (1953)

THOMA, K H., H D HOWE, and M WENIG "Tumors of the mouth and jaws," *Am J Orthodontics Oral Surg* (Oral Surgery Section) 31:260–288 (1945)

CHAPTER 23

ODONTOGENIC HAMARTOMAS

Hamartomas comprise a diversified group of tumorlike malformations found in many organs of the body (lung, liver, kidney, etc) The hamartomas of dental origin, like the others, are composed of a purposeless mixture of the normal components of the dental organ The amounts of these tissues, their structure, and degree of maturity may vary, because all cells of the same type do not proceed on the same time schedule of differentiation Some reach maturity rapidly, others slowly, and some remain at a low level of differentiation These hamartia are presumed to develop from embryonic tissue left over from odontogenesis, and are not considered to be the result of intermutability of mesenchymal cells Either a histogenetic stimulus or an inductive effect of one tissue on another, or both, probably operates in the production of these lesions

ENAMELOMA

Enamelomas are small, self-limited lesions composed of enamel They are seen usually along the side of the root of a permanent, erupted or unerupted, tooth They are epithelial in origin and are formed from remnants of the enamel organ

Although trauma, faulty nutrition, and inflammation have been proposed as possible inciting factors, these probably play no part in the process.

The enameloma is commonly found at the bifurcation of the roots of the molar and premolar teeth and at the cervical margin of the single-rooted teeth On gross examination the lesion appears as an enamel drop or pearl, and is usually firmly adherent to the related tooth root. Microscopically, the enamel is dissolved during the decalcification process, on preparing the section, a clear space is left which is surrounded by atrophic epithelial cells Enamelomas are extremely rare in the pure state, and often a core of dentin extends into their center, occasionally, cementum will partially or completely cover them

Enamelomas are symptomless and are discovered only by routine roent-



FIG. 23 1—Enameloma, which is characteristically a densely radiopaque structureless lesion approximating the root of the cuspid tooth.



FIG. 23 2—Rudimentary tooth in relation to the central and [illegible] which may be distinguished from an enameloma in the midline [illegible] the presence of the dental canal

genographic examination. They appear as spherical opacities with typical odontic relations The structure is homogeneous and may be confused with rudimentary teeth, but in the latter a pulp canal can usually be demonstrated

Treatment is rarely indicated, although if the adjacent tooth is extracted the lesion should be removed at the same time

DENTINOMA

Dentinoma is an extremely rare lesion and has not been adequately documented in the pure state. The lesions reported as dentinomas have been associated with cementum and enamel For this reason these should be considered as odontomas However, there is no reason why a pure dentinoma (without enamel) should not exist, and the presence of cementum in such a lesion could be explained as osseous repair following degeneration of the odontoblasts

The dentinoma (so-called) is a self-limited growth and lacks many of the other characteristics of true neoplastic processes Dentinomas are usually located in the region of the crown of an unerupted permanent tooth and, grossly, are irregular, spherical masses of extreme density Microscopically, these lesions are a conglomerate of dentin, osseodentin, cementum, enamel voids, and a minimum of connective-tissue stroma

The roentgenographic appearance is that of a well-marginated density surrounded by a thin radiolucent line The radiopaque area appears to be related to the crown of an unerupted tooth Dentinoma should not be confused with denticle (pulp stone), which is a common uniform opacity in the pulp of teeth.

Surgical intervention, with removal of these lesions, is frequently necessary to permit the eruption of the related tooth.

ODONTOMA

The terms *odontoma* and *odontoblastoma* have been loosely used to include all the benign tumors which are derived from tissues presumed to have the potentiality of forming tooth substance More correctly, the term *odontoma* should be restricted to refer only to those lesions which consist of enamel, enamel-producing epithelial structures, dentin, and dentin-producing mesothelial structures, and the several combinations of these components These lesions are nonneoplastic and are subject to wide variation in morphologic, histologic, and chronologic developmental patterns Additionally, cementum and cementum-producing mesenchymal structures are frequently found in association with these hamartomas, but



FIG. 23 3 (*Upper left*)—Dentinoma is seen as a completely calcified structure which has interfered with eruption of the third molar and deformed its roots. A fibrous capsule surrounds it so that it is like a periapical dysplasia (cementoma)

FIG. 23 4 (*Upper right*)—Soft and calcified odontoma. The irregular calcification related to the occlusal aspect of the partly erupted third molar tooth is surrounded by a mass of immature connective tissue

FIG. 23 5 (*Lower*)—A completely formed compound odontoma appearing as a spherical area of increased density over the apical half of the root of the maxillary second bicuspid, extending superiorly and distally into adjacent space normally occupied by the first molar A crown is clearly outlined within the encapsulated mass

periapical fibrous dysplasia (cementoma) should not be considered among the hamartia of dental origin.

Odontomas may be classified according to histologic components, degree of differentiation, and ability to form calcified structures.

Histopathology

Odontomas are composed of an abnormal mixture of the normal constituents of teeth or tooth-forming tissues in abnormal locations. The embryologic factors precipitating these abnormal developments are not known.

Soft Odontoma. This growth consists mainly of a connective-tissue stroma and epithelium. The epithelium is composed of columnar cells (ameloblasts) in varying combinations which may be in plexiform strands dividing the stroma into lobules, or in solid buds simulating a distorted early enamel organ. These epithelial buds may have a central stellate reticulum with peripheral cells, although this may be replaced with squamous cells. The stroma may vary between mature and immature fibroblasts, the latter resembling those seen in the dentinal papilla.

Soft and Calcified Odontoma. At first this appears to be a congeries of individual portions of tooth structures without any pattern of interrelationship. However, closer study of the bizarre mixture discloses characteristics suggestive of the inductive effects of one tissue on another. This influence between epithelium and connective tissue results in production of dentin, enamel, cementum, and bone.

Completely Formed Odontoma. This lesion is subdivided into the compound and complex types. The compound odontoma, on gross examination, is composed primarily of numerous rudimentary teeth of various sizes and an occasional normal tooth. These are enclosed in a fibrous capsule. Microscopically, the teeth are seen to differ from normal teeth only in size, and are separated by fibrous tissue, cementum, and bone. The complex odontoma is an abnormal mixture of tooth structures in different stages of development. They are hard, ill-shaped, encapsulated masses occasionally attached to an unerupted normal tooth. Microscopically, there is found a broad range of structural patterns, because of the fact that the tissues are at different levels of differentiation. This results in an abnormal arrangement of dentin, enamel, cementum, and pulp tissues.

Clinical Characteristics

Odontomas are demonstrated usually in young adults. They may develop in either jaw but are more frequent in the mandible and are most commonly found in the molar area.

All members of the group are asymptomatic for long periods, and



FIG. 23 6—Completely formed compound odontoma made up of multiple formed teeth with some degree of encapsulation around each one Since the deciduous cuspid is still in place the lesion apparently arose from the tooth germ of the permanent cuspid





FIG 23 7 (*Left*)—Completely formed compound odontoma consisting of multiple rudimentary teeth occupying alveolar bone beneath a fixed restoration Partial encapsulation of each component is demonstrated

FIG 23 8 (*Center and right*)—Completely formed compound odontoma below the cuspid and bicuspid teeth Many small teeth are encapsulated in the mass, and since all the more anterior permanent teeth are present, the lesion probably arose from the tooth germ of a supernumerary tooth





FIG 23 9 (*Left*)—Completely formed compound odontoma placed between deciduous and permanent cuspids and obstructing the eruption of the latter teeth, strongly suggesting cuspid tooth-germ origin

FIG 23 10 (*Right*)—Completely formed compound odontoma in the cuspid region Deciduous cuspid occupies position of the missing lateral incisor Many small teeth can be seen in this mass The permanent cuspid is unerupted, and this lesion in all probability arose from the germ of the lateral incisor



FIG. 23 11 (*Upper*)—Completely formed complex odontoma approaching the alveolar crest and made up of a purposeless mixture of opacities without ana tomical form Partial encapsulation is seen in this film

FIG. 23 12 (*Lower*)—Completely formed complex odontoma with a distin guishable supernumerary tooth surrounded by a nearby amorphous, opaque mass. Encapsulation of both rudimentary tooth and odontoma is well demon strated.

the majority are recognized on routine roentgenographic examination The only clinical indications which may be present are the absence of a tooth from the dental arch, localized malalignment of teeth, or an expansion of bone *Some odontomas tend to erupt, but the eruption* usually is not initiated unless the adjacent teeth are extracted



FIG 23 13 (*Left*)—Completely formed complex odontoma in the edentulous central incisor area, seen as a conglomerate mass of radiopacities, irregular in size and shape It is well encapsulated, and mature fibrous tissue separates the small denticles

FIG 23 14 (*Right*)—Completely formed complex odontoma lying superior to the deformed crown of the cuspid tooth, which shows nearly normal root development and persistence of a normal coronal crypt The lesion contains a conglomeration of cementum and osteoid tissue, as well as rudimentary teeth, and undoubtedly represents abnormal development of the cuspid tooth.

Both the extremely rare soft and more common hard varieties have *the same clinical course, and their distinguishing features become evident* only through roentgenographic or pathologic study

Roentgenographic Appearance

Odontomas produce an extremely varied roentgenographic appearance Multiple projections and optimum technique are essential to disclose the detailed texture of these lesions, as well as their odontic relations



FIG. 23 15—Completely formed complex odontoma containing a rudimentary tooth, both the product of the second bicuspid tooth germ The encapsulated rudimentary tooth is surrounded by a mixture of enamel dentin, and osseous tissue. The impacted second molar has a normal coronal portion and a dis torted root development.



FIG 23 16—Completely formed complex odontoma is observed over the root of the central incisor and extends from the gingival margin to the apex. The mass appears to be encapsulated, and as no permanent teeth are missing, the lesion probably arose from a supernumerary tooth germ



FIG 23 17 (*Left*)—Completely formed complex odontoma producing expansion of the lingual aspect of the mandible The process is an almost homogeneous mixture of enamel, dentin, and osseous tissue

FIG 23 18 (*Right*)—Same case as in Fig 23 17 Expansion of the mandible, including medial deviation of the myelohyoid ridge, is demonstrated, while evidence of encapsulation and thinning of cortical bone are more clearly seen than in previous view

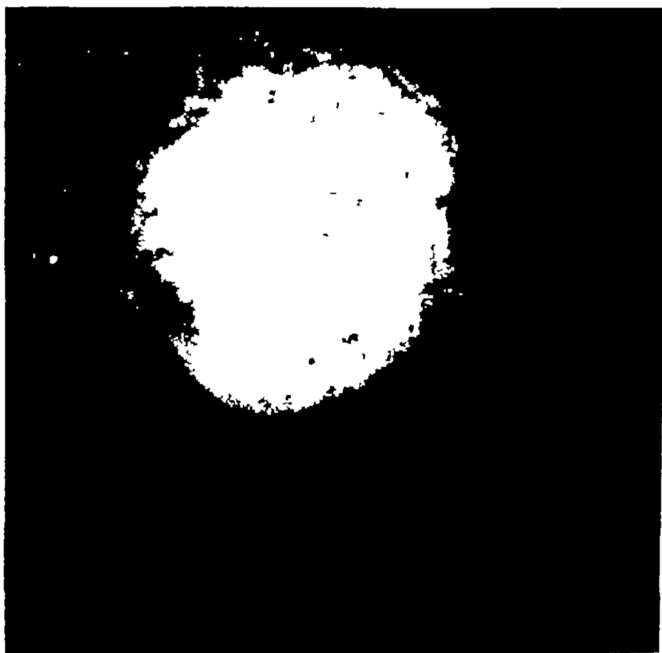


FIG 23 19—Completely formed complex odontoma residual in an edentulous alveolar ridge and partially erupted Superficial ulceration of the overlying mucosa called attention to this otherwise asymptomatic lesion

Soft Variety This odontoma is without calcific material and appears either as a uniform round pseudocystic radiolucency or as multiple radiolucencies with fairly well-defined sclerotic margins which are diffi cult, if not impossible to differentiate from odontic cysts and soft tumors

Soft and Calcified Odontomas These growths contain enamel, dentin bone, and cementum as well as epithelium and connective tissue. Ac cordingly the appearance is that of a partly radiolucent and a partly



FIG. 23 20—A cystic odontoma apparently involving the crown of the partially erupted cuspid tooth but seen in the second view to be separate from the related teeth. The amorphous radiopacities lie completely within a lobulated radiolucent zone The lesion is distinguished from a soft calcified odontoma by the peripheral line of sclerosis and the uniform radiolucency

nondescript coalescence of varying opacities Superimposition of calcified structures may produce completely amorphous densities as well as a purposeless interspersion of less calcified structures A well-defined margin is in part made up of a definite radiolucent zone indicating the fibrous encapsulation.

Completely Formed Odontomas Two types are recognized the com pound types with a large number of more or less small or rudimentary teeth, and the complex type with irregular tooth structure bearing no resemblance to tooth formation The *compound type* usually appears as an irregular mass with a multilobular margin because of the small rudimentary deformed or even normal teeth. The degree of opacity may vary with the number and superimposition of the teeth, and the struc



FIG 23 21—Cystic odontoma extending from cuspid to contralateral bicuspid The rudimentary crown of a cuspid tooth is seen fused with many coalesced bodies of enamel, dentin, and osseous tissue Periodontal cyst should be considered because of the indefinite peripheral margin and the advanced caries of the biscuspid teeth The absence of the cuspid tooth, however, suggests follicular origin for this cyst



FIG 23 22—Dens in dente The root is undeveloped, probably because of an inflammatory process Within the crown and in the upper portion of the root area of the lateral deciduous incisor, a lesion appears as an atypical tooth possessing a rudimentary crown The inner tooth presents a large pulp cavity with a thin layer of coronal enamel

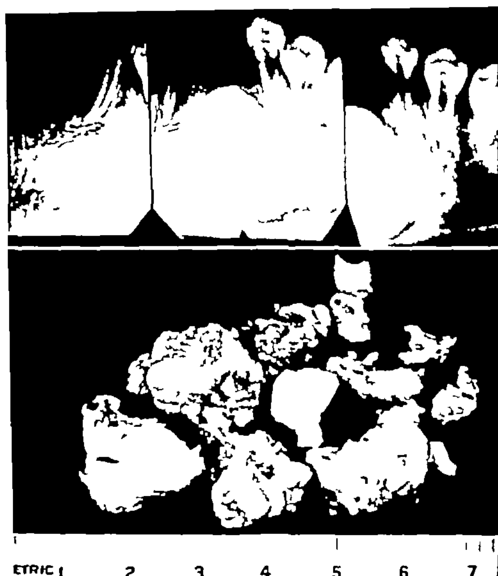


FIG. 23 23 (*Upper*)—Completely formed complex odontoma extending from beyond the midline to the molar region The mass is of uniform density except for several small zones of decreased density in its posterior portion. The permanent cuspid is unerupted, and there is a deviation of the roots of the lateral incisor and of both bicuspids

FIG. 23 24 (*Lower*)—Surgical specimen of case in Fig 23 23 showing a partly formed cuspid crown in the center surrounded by masses of enamel, dentin, and osseous tissue. (*Courtesy of Gordon Fitzgerald D.D.S*)

ture of individual components can often be recognized The *complex odontoma* produces an irregular, opaque, rounded or oval mass surrounded by a fine line of radiolucency which is due to the fibrous capsule All the stages of odontogenesis may be represented, from structures





FIG 23 25 (*Left*)—Cystic odontoma lies between the deciduous and permanent lateral incisors The crowns are well formed The structure is not homogeneous and contains scattered immature connective tissue within a cystic cavity well demarcated by a peripheral sclerotic margin

FIG 23 26 (*Right*)—Same case as in Fig 23 25 two months postoperatively, with partial regeneration of normal bone and preservation of the permanent lateral incisor tooth

appearing like normal tooth formation to irregular, abnormal arrangement of tooth substance with enamel, dentin, and cementum The irregular appearance of this opaque structure is produced by the different densities of the hard substances as well as by the soft tissues interspersed throughout the mass Sometimes, unerupted, normally formed teeth may be fused with the lesion A follicular cyst may occasionally contain a completely formed odontoma which may be seen to partially fill the cystic space

Treatment

Odontomas are benign lesions and the treatment of choice is conservative surgical excision. The soft odontoma cannot be conclusively diagnosed from clinicoroentgenographic findings and its removal without delay should be recommended

The various types of calcified odontomas require carefully planned, conservative surgery A capsule invariably surrounds all these lesions and the removal of the small ones is accomplished without great difficulty The large lesions and others which partially obstruct normal teeth, may require a temporary decompression to permit partial eruption of the teeth. Later the contents and capsule of the lesion can be removed without danger to dental structures A two-stage procedure is an advantage in some of these cases It not only permits maximum conservation of structure but is an additional precaution against fracture of the jaw

READING REFERENCES

THOMA, K. H., and H M GOLDMAN "Odontogenic tumors Classification based on observations of epithelial, mesenchymal and mixed varieties" *Am J Pathol* 22:433–471 (1946)

TRATMAN E. K. "The classification of odontomes" *Brit Dental J* 91:167–173 (1951)

Introduction to Part Five

By definition cysts of the jaws are abnormal spaces within bone, lined with epithelium and filled with fluid, debris or a semisolid exudate. The traumatic bone cyst (unicameral bone cyst) and the bone space are included in the classification but are not true cysts since they are not lined with epithelium, and if fluid is present it is a transudate.

Not only are cysts common but many different types occur in the maxilla and mandible and all are in relatively close proximity to the teeth. Many classifications have been employed in the past and for practical purposes two groups are recognized those related to dental development and structures (the odontic cysts) and those related to osseous tissues not derived from dental origin (the nonodontic cysts)

CYSTS OF THE JAWS

- I Nonodontic cysts
  - A. Fissural cysts
    - 1 Median
    - 2. Globulomaxillary
    - 3. Dermoid
  - B Nonfissural cysts
    - 1 Nasopalatine
    - 2. Palatine papilla
    - 3 Traumatic
    - 4. Aneurysmal bone cyst
    - 5 Bone cavities
- II Odontic cysts
  - A. Periodontal (radicular)
  - B Follicular
    - 1 Primordial
    - 2. Dentigerous

Cysts are not considered as true tumors for their growth pattern does not fulfill all the requirements of neoplastic activity Once the inciting stimulus or irritation has developed to produce degenerative changes in a cell or group of epithelial cells a cyst may develop The destruction of surrounding bone is on the basis of pressure absorption. The continued slow growth of all cysts is largely dependent upon the principle of

osmosis Positive capillary pressure around the cyst causes transudation but resorption into the venous capillary bed is prevented by the high osmotic pressure of the cystic fluid The proliferation of epithelium commonly observed in the cysts is not a neoplastic process, for the main *stimulus for this formation is intracystic pressure*

The tentative diagnosis between nonodontic cysts, odontic cysts, and the several solid tumors is important This is accomplished by a combination of roentgenographic studies from various angles to determine odontic relations vitality tests of teeth, aspiration, and occasionally minor surgical procedures for biopsy, as the final diagnosis can be determined only by microscopic examination

PART FIVE

Cysts of the Jaws

CHAPTER 24

Nonodontic Cysts

All true cysts, whether of odontic or nonodontic origin are lined with epithelium and contain fluid The great majority of nonodontic cysts originate in the medullary portion of the jaws and only secondarily involve alveolar bone They most often arise in the points or lines of fusion between the bony components The developmental anatomy of the maxillae is therefore important to the understanding of these cysts.

APPLIED ANATOMY

The globulomaxillary process of the premaxilla is the anterior triangle which contains the paired central incisor teeth The incisive canal forms the posterior apex of this triangle. At this point a fusion exists between the right and left palatine processes of the maxillary bones and the premaxillary portion The median suture of the palate runs posteriorly from this point. Anteriorly each palatine process diverges laterally on an angle which passes through the interspace between the lateral and cuspid teeth (or slightly medial to this position) Thus the posterior median suture of the process and the right and left globulomaxillary sutures are formed. Cysts arise embryologically from enclaved epithelium and may occur at any position along these suture lines.

The incisive, or nasopalatine canal has its orifice in the midline of the palatal aspect of the premaxilla just anterior to the termination of fusion of the right and left palatal processes of the maxilla and just posterior to the interspace between the upper central incisor teeth. From this point, the nasopalatine canals run posteriorly and superiorly communicate with the anterior meatus of the nose and are the site of the nasopalatine cyst.

A fissural type of cyst may also appear in the median fissure of the mandible at the embryologic line of fusion between the left and right halves of these structures These cysts developing in association with the osseous structures of the oral cavity may be conveniently divided into the median and the globulomaxillary groups.

MEDIAN CYSTS

Median cysts (fissural) are epithelial-lined cavities, of developmental origin, which are located in the median fissures of the maxilla and mandible The median palatal cysts are much more common, and distinction is made between the alveolar median and posterior median cyst The mandibular median cyst is rare, and it has a characteristic anatomic location

Incidence

Median cysts may appear at any age, in all races, and frequency of occurrence is divided equally between male and female Although they are relatively rare, these cysts appear sufficiently often to be important in the differential diagnosis of any space-occupying lesion of the jaws

Etiology

Median cysts are thought to arise from the inclusion of epithelial-cell remnants between the palatine processes as they fuse in the first period of embryonic life Activation of these dormant inclusions between the osseous members is presumed to be due to trauma or direct pressure from growth and development of the dentition As the proliferation of cells continues, liquefaction and desquamation of these elements provide the original fluid Once initiated, the process is continued by transudation, produced by positive capillary and osmotic pressures As the cells pass through their normal life cycle they are desquamated into the fluid contents, maintaining a hypertonic state.

Pathology

In this type of cyst, the cells of the epithelial lining are usually squamous, but occasionally they are cuboidal or columnar The cells originating from the oral cavity are squamous, and if cells from the nasal cavity are present, they may be cuboidal or columnar The squamous type of lining may consist of two, three, or many cell layers, and occasionally papillary ingrowths are present Infrequently, glandular inclusions are observed When infection is present, metaplasia of the epithelium or destruction of part or all of the cyst lining may result Thus a true cyst may be found without an epithelial lining The epithelium is supported by a fibrous tissue layer which varies in thickness Rarely inflammation may be present The cystic cavity is usually filled with a straw- or brownish-colored liquid, and at times cellular debris, cholesterol flecks, and blood pigments are found in the contents

Clinical Characteristics

Early symptoms are usually absent and do not appear until considerable size is attained. Frequently first symptoms are associated with superimposed infection trauma or fracture

Median cysts, progressing to considerable size before discovery pre-

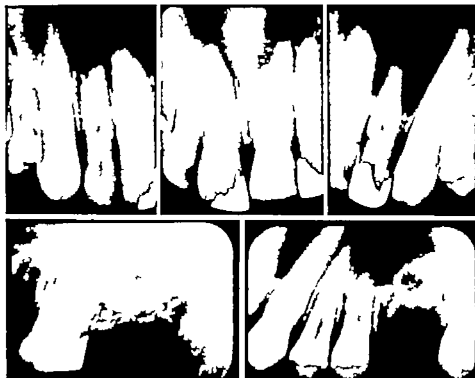


FIG. 24 1—Median anterior palatine cyst separating the roots of the central incisor teeth and extending posteriorly to the left molar area and to the cuspid area on the right.

sent with initial complaints in the following order of frequency swelling, displacement of teeth, crepitus pain spontaneous drainage displacement of dentures and local irritation.

Roentgenographic Appearance

The median cyst appears as an unilocular radiolucent area with a clearly defined peripheral border In the anterior alveolar location the central incisor roots may be deviated laterally producing malposition of the crowns of the midline teeth. Both palatal and alveolar median cysts vary in shape from spherical to ovoid Inflammatory reactions within this cyst seldom progress to the point of destruction of the entire dense bony margins and part of the dense peripheral zone may be demonstrated with multiple roentgenographic views.



FIG 24 2—Median palatine cyst extending posteriorly to the second bicuspid on the left, including the first molar root on the right The teeth have been displaced in various directions, resulting in numerous diastemas, and even with these displacements, the remaining periodontal structures and teeth are relatively firm

Diagnosis

An asymptomatic swelling with roentgenographic evidence of a midline radiolucent area in the maxilla or mandible provides good support for a tentative diagnosis of median cyst Sufficient roentgenograms must be taken to demonstrate all margins of the cyst Aspiration of the defect is required to determine its cystic or solid (soft-tissue neoplasm) character However, microscopic examination of the aspirate will not distinguish between types of cysts A biopsy solely for the purpose of obtaining a portion of cyst lining for microscopic examination is not usually a feasible procedure but may be performed at the time of the definitive surgical treatment

Treatment

Conservative surgery is emphasized for all developmental cysts and particularly for those not complicated by inflammation Careful preoperative consideration should be given to the interpretation of roentgeno-



FIG. 24 3—Median palatine cyst with a smooth partly sclerotic margin. The diastema between the central incisors and the further displacement of their roots suggest that the cyst has exerted considerable expanding pressure against the dental arch. Multiple views would be required to differentiate this lesion from a nasopalatine cyst.

grams, to pulp testing, and to the best approach to avoid injury to vital teeth Surgical exposure and enucleation of the epithelial lining is the method of choice for small cysts and for those occurring in areas where there is little possibility of endangering the periapical blood supply and vitality of the adjacent teeth Even more extensive maxillary cysts rarely



FIG 24 4—Median mandibular cyst extending posteriorly to the left first molar and to the right second bicuspid Both alveolar and cortical bone have been destroyed In addition, periodontal disease involves the anterior area and the mesial aspect of the left second bicuspid The apical divergence involving the central incisors is the most suggestive diagnostic point

communicate with the oral, antral, or nasal cavities, but as they increase they may encroach on these spaces The cyst wall is often the only barrier between these cavities, and its destruction is to be avoided Accordingly, a Partsch operation is indicated where it is impossible to perform complete enucleation of the cyst lining If this is not feasible, the acrylic collar button with the continuous drainage may be a desirable procedure.

Prognosis

The prognosis of the median cyst is uniformly good, for the frequency of carcinomatous changes is extremely low Although the conservative drainage-type of treatment for the larger cysts is prolonged, aesthetic

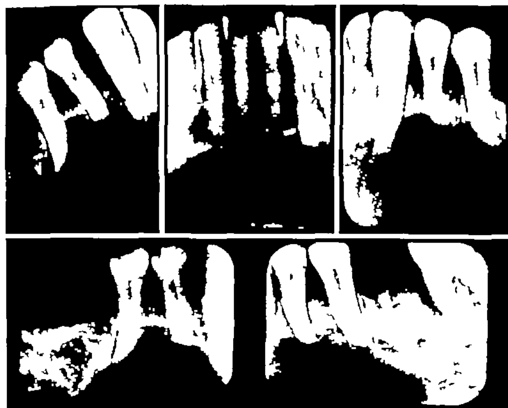


FIG 24 5—Median mandibular cyst extending bilaterally beyond the bicuspids. The apices of the right first bicuspid and the left first and second bicuspids present blunting, suggestive of root resorption. This finding is somewhat unusual, as median cysts generally tend to displace the teeth rather than to cause resorption.

results, from the standpoint of dental structures and facial contours at the termination of treatment, are excellent.

GLOBULOMAXILLARY CYSTS

Globulomaxillary cysts or intraosseous lateral fissural cysts, arise in medullary bone between the lateral incisor and cuspid teeth of the upper jaw Their incidence is somewhat less than that of the median cysts of the maxilla.

Etiology

These cysts arise from epithelial inclusions in the line of fusion between the diagonal margin of the palatine process and the premaxilla which is formed embryologically from the globulomaxillary process The cystic lining is of the squamous-cell type from the oral epithelium in the major ity of cases. The reactivation of epithelial elements entrapped in these

fissures is not fully understood The formation of fluid and gradual enlargement are similar to those described for the median cysts

Pathology

The cysts tend to extend downward into the alveolar bone between the roots of the approximate teeth, causing the crowns to converge and



FIG. 24 6—Globulomaxillary cyst which has already caused a malalignment of the crowns, a separation of roots, and nearly complete absorption of alveolar bone

the roots to separate progressively with the increasing size of the cyst The cyst lining varies from three to many layers in thickness, although it is rarely of cuboidal or columnar pattern A fibrous capsule surrounds the epithelium and separates it from the bone The contents are usually fluid and amber colored, unless complicated by infection or pathologic fracture

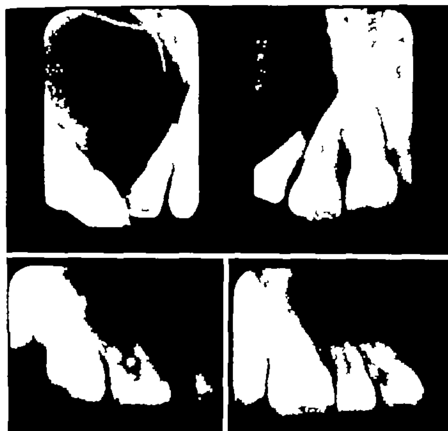


FIG. 24 7—Globulomaxillary cyst with marked divergence of the roots and destruction of both alveolar and cortical bone The cyst involves the entire half of the palate back to the second molar area

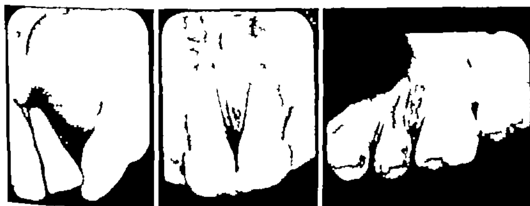


FIG. 24 8—Globulomaxillary cyst with malalignment of the crowns, deviation of the roots of lateral incisor and cuspid teeth and complete resorption of bone in the hard palate from the midline to the left first molar area.



FIG 24 9—Globulomaxillary cyst extending from the left central incisor to the left second molar The presence of the fractured, nonvital lateral incisor suggests a diagnosis of periodontal cyst, but root divergence cannot be explained on this basis This cyst, however, was infected



FIG 24 10—Globulomaxillary cyst on the right which has involved the hard palate beyond the bicuspids, and a periodontal cyst on the left which has developed from a devitalized lateral incisor tooth

Clinical Characteristics

The earliest clinical sign may be a unilateral convergence of the lateral incisor and cuspid teeth with an accompanying swelling of the labial aspect of the alveolar process. Early subjective symptoms are rare and often these cysts may assume large proportions before they are detected Primary infection does not occur but after spontaneous or traumatic



FIG. 24 11—Same patient as in Fig 24 10 showing relationship of the two cysts on an occlusal film

drainage, tenderness and pain may indicate this complication As the cyst develops, it encroaches upon the antrum and may displace it, or downward pressure may cause a convexity of the hard palate

Roentgenographic Appearance

A unilocular radiolucent area is seen which characteristically has a teardrop shape and replaces alveolar bone between roots of displaced teeth. Occasionally minute cysts will appear to be located completely within a diastema between the roots of the involved teeth. Large cysts not only may cause destruction of the premaxillary portion of the palate

but may extend distally and involve the palatine process as far posteriorly as the second bicuspid and molar teeth The roots of the displaced teeth, almost invariably, remain outside the cystic cavity Demonstration of this diagnostic point may often be made with multiple roentgenograms, with or without the aid of radiopaque contrast materials



FIG 24 12 (*Upper*)—Globulomaxillary cyst with marked separation of involved teeth and destruction of alveolar and cortical bone from beyond the midline to the second molar area

FIG 24 13 (*Lower*)—Same patient as in Fig 24 12 one year postoperatively Treatment consisted of biopsy, continuous drainage, and later enucleation of the cyst membrane Replacement of cystic cavity by newly formed bone is well demonstrated (*Courtesy of Paul H. Hamilton, D D S*)

Diagnosis

The differential roentgenographic diagnosis between these globulomaxillary cysts and periodontal cysts is often difficult It is only when they are small that it is technically possible to demonstrate their separation from the adjacent teeth by a persistent lamina dura However, the majority may be readily distinguished from periodontal cysts by pulpal vitality tests A final diagnosis, however, must be based on complete

clinical and roentgenographic study and by histologic examination of the cyst lining.

Treatment

Globulomaxillary cysts are usually treated by continuous drainage The alveolar ridge is entered between the lateral incisor and cuspid teeth biopsy is taken of the cyst lining and a retention drain is introduced into the vertex of the cyst Sutures are usually required to retain the tube in place. The suture is replaced with a clean tube over intervals of from one to four weeks, depending on local requirements The cystic cavity will gradually decrease in size, under continuous drainage to a point when enucleation of the cyst membrane may be accomplished without endangering the vitality of the adjacent tooth.

Prognosis

The prognosis under conservative treatment is uniformly good. Realignment of displaced teeth may be accomplished with orthodontic procedures.

DERMOID CYSTS

Dermoid cysts (so-called) are of congenital origin and are caused by enclavement of the ectoderm at the time of the closure of the embryonic fissures. Usually these cysts in the mouth or jaws contain epithelium and epithelial appendages and should not be confused with teratomas which usually contain teeth, hair and portions of organs

Dermoid cysts are very rare in the jaws or palate and are most common in the anterior floor of the mouth. Their usual site is behind the symphysis and, although present at birth, they usually are not discovered until several years later Growth is slow and they remain asymptomatic for many years Ultimately complaints of swelling in the floor of the mouth or palate and of soreness or pain in the area attract attention to the lesion As the lesion progresses it frequently causes a pressure destruction on adjacent bone

The gross pathology is that of a fibrous sac containing fluid and sebaceous material. Microscopically the sac is lined with epithelium with dermal appendages, the latter consisting of hair follicles and sebaceous glands

The treatment is the removal of the cyst with the capsule intact.

NASOPALATINE CYSTS

Nasopalatine cysts (nonfissural) are sometimes referred to as incisive canal cysts and may occupy one or both of these canals. Although ap-

pearing in close proximity to the midline and often related roentgenographically to the incisor teeth, they are usually distinguishable from the median cyst.

Etiology

These cysts arise from epithelial remnants of the nasopalatine ducts, which are usually obliterated in the course of embryonic development

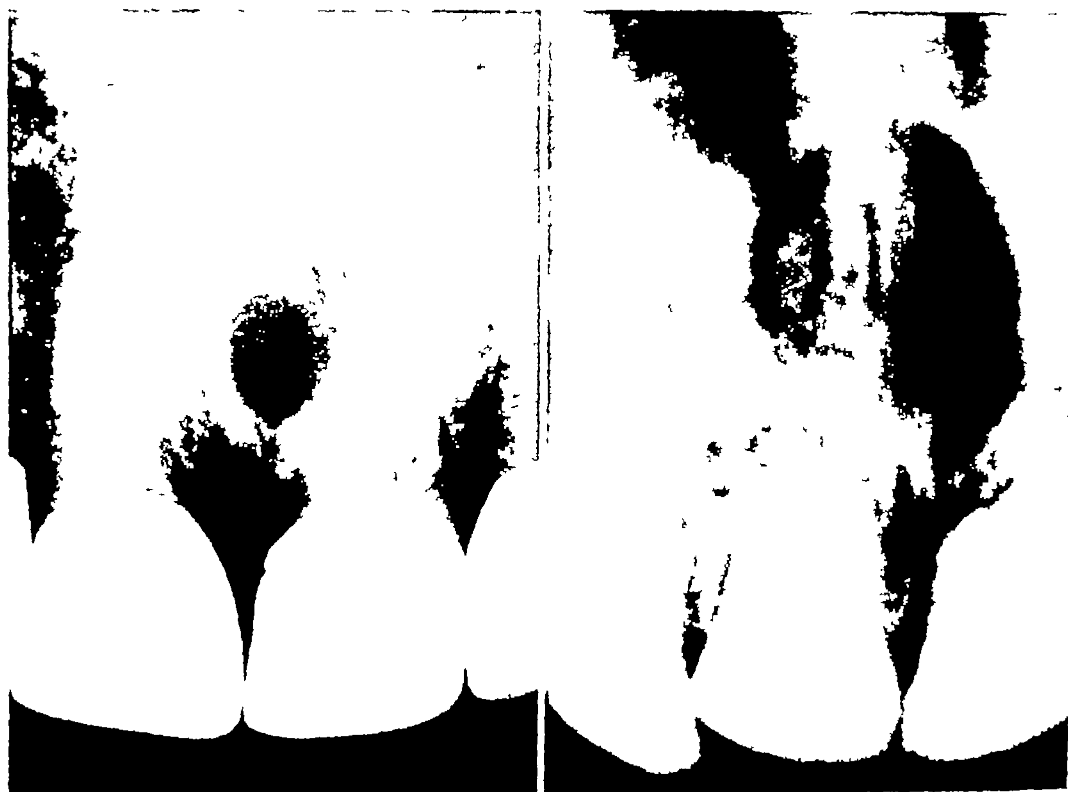


FIG 24 14 (*Left*)—Nasopalatine duct cyst with a well-defined sclerotic margin and marked lateral resorption of the left central incisor root

FIG 24 15 (*Right*)—Nasopalatine duct cyst with a typical oval shape and increased rarefaction of alveolar bone between the separated roots of the central incisor teeth

Sometimes they remain partially or completely patent in the mature individual and at any time may become infected through either the nose or mouth The sequences in the development of these cysts are similar to those discussed for other developmental cysts, although infection in this location may be the inciting agent

Histopathology

The epithelial lining may be squamous or columnar, according to its origin from the oral or nasal portion of the palatine duct. The squamous

type of epithelium is usually associated with serous fluid while the columnar type of lining may produce a mucoid liquid The fibrous peripheral capsule varies in thickness with the degree and duration of inflammation.

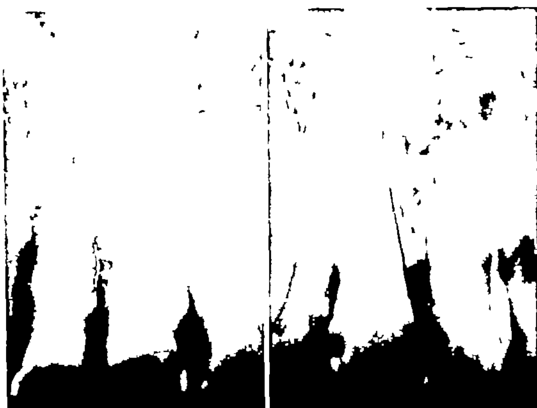


FIG. 24 16 (*Left*)—Nasopalatine duct cyst with an unusually pronounced sclerotic margin. The nasopalatine canal is visualized within the cyst outline
FIG. 24 17 (*Right*)—Bilateral cysts of the nasopalatine ducts with the typical heart-shaped outline The margin is well outlined by the radiopaque sclerotic bone on one side but is not advantageously shown at this angle on the other side. The roots of the teeth are normal, and the lamina dura is well shown around the apices of the teeth suggesting that their pulps are normal in spite of the presence of large Class III radiolucent restorations

Clinical Characteristics

The presenting symptom for the majority of cases is soreness from inflammation However many cysts remain symptomless and have been followed for years with little or no progress Large cysts produce swelling either along the midline of the anterior portion of the hard palate or in the floor of the nares, with tenderness and generally an intermittent discharge Infection in these cysts is common Rarely they develop in both incisive canals simultaneously

Roentgenographic Appearance

The typical cyst appears as a spherical or oval, well-demarcated radiolucent area, with a dense periphery located in the midline of the maxilla near the incisive foramen Typically a cyst may develop asymmetrically



FIG 24 18 (*Left*)—Nasopalatine duct cyst with a well-defined peripheral zone of increased density The cyst is in close proximity to the root of the right central incisor

FIG 24 19 (*Right*)—Same case as in Fig 24 18 four years later On this film alone it would be difficult to differentiate this nasopalatine duct cyst from a periodontal cyst except for the fact that the lamina dura is intact The tooth had remained vital

and cause a displacement of a root of the central incisor tooth Occasionally both canals are involved and a characteristic heart-shaped lesion may be produced

Differentiation from the median alveolar cyst is frequently difficult, but the nasopalatine cysts are located more distally Differentiation from a periodontal cyst may be accomplished, with the aid of pulp vitality tests and multiple roentgenograms, by demonstration of positional change



FIG 24 20—Same case as in Figs. 24 18 and 24 19 Films from various angles demonstrate close proximity of cyst to right central incisor apex. Vitality tests were within normal limits.



FIG 24 21—Nasopalatine duct cyst in an edentulous jaw The margins are well sclerosed, except anteriorly, where a chronic fistula is present

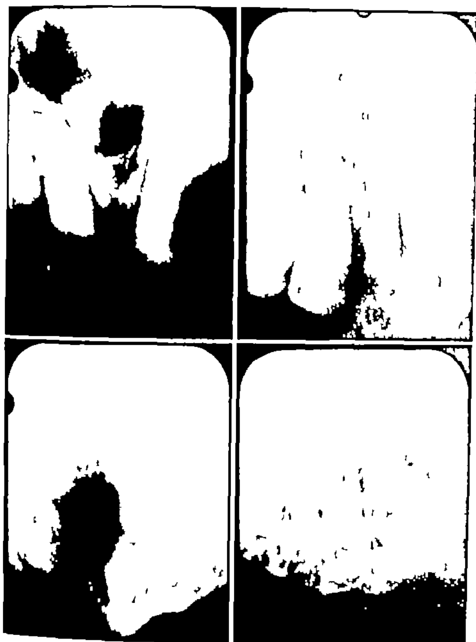


Fig. 24 22 (*Upper*)—Nasopalatine duct cyst extending from the midline region above the roots of the right central and lateral incisor teeth The fractured lateral incisor was not in communication with the cyst, which was sterile.

Fig. 24 23 (*Lower*)—Same case as in Fig 24 22 eighteen months after cystectomy Almost complete regeneration of bone has occurred in the lateral incisor region, and the radiolucent area seen in the midline is due to the surgical defect in the labial plate (*Courtesy of Paul H Hamilton D D.S*)

in relation to neighboring teeth Rarely, an incisive foramen may be quite large and simulate a small incisive cyst.

Treatment

Drainage and usually antibiotic therapy are required when inflammation is present When this has subsided, or in the absence of infection, a soft-tissue flap is made and a complete enucleation of the epithelial lining is accomplished

Prognosis

The prognosis is uniformly good

CYSTS OF THE PALATINE PAPILLA

Cysts of the palatine papilla (nonfissural) occur within the soft-tissue limits of that structure They are not primarily intraosseous but may cause bone resorption from the pressure of their enlargement Trauma or inflammation is usually considered to be an inciting factor Symptoms of inflammation, pain, and interference with mastication are common Ordinarily, these cysts are not demonstrated roentgenographically. The treatment consists of incision and drainage, if infection is present, and subsequent excision

TRAUMATIC CYSTS

Traumatic cysts, also called hemorrhagic or extravasation cysts, of the mandible are not unlike the unicameral bone cysts seen in the appendicular bones of the otherwise normal skeleton They are not true cysts since there is no epithelial lining, otherwise they fulfill the criteria for true cysts

Etiology

A history of trauma is given for the majority of these lesions in the mandible However, this inciting factor is not so common for lesions elsewhere in the skeleton, where they are believed to be local developmental defects

Males predominate over females in a ratio of 4 1. The incidence is greatest between the ages of sixteen and twenty years

Pathology

A traumatic cyst of the jaws is rare when compared with its counterpart, the unicameral cyst, which occurs elsewhere in the skeleton It has a predilection for development in spongy bone containing hemopoietic



FIG. 24 24 (*Upper*)—Traumatic cyst causing an ill-defined radiolucency subapical to the first molar The lamina dura is intact. The pseudoseptal division extending downward from the mesial root to the base of the lesion, as well as absence of the sclerotic margins, aids in differential diagnosis from true cysts. FIG 24 25 (*Lower*)—Traumatic cyst causing a divergence of the bicuspid roots without affecting the lamina dura or producing root absorption.

marrow but it occurs only in those bones with a heavy, compact cortical layer This may explain the selective occurrence in the mandible and in the metaphysis of the long bones The initial factor may be trauma, followed by a hematoma in red bone marrow Subsequent necrosis of the trabeculae as well as of the marrow itself, takes place Liquefaction of the clot occurs, and the initial cystic cavity is formed When the expanding cyst reaches compact bone, further progression is severely retarded, and only rarely is there an expansile alteration in the contour in the body of the mandible

The lesion is always solitary and is found only among facial bones and in the mandible The sites of origin are equally divided between the molar and incisive areas

The cavity usually contains fluid, with a scant amount of granulation tissue and edematous connective tissue Rarely is the cavity entirely empty, without either liquid or the fibrous capsule that is commonly seen in unicameral bone cysts The fibrous capsule, or lining, when present, varies greatly in thickness and distribution, with some osseous margins exposed

Clinical Characteristics

A history of trauma, transient pain, and swelling may be elicited from the majority of patients, but symptoms from the lesion itself may appear from a year to years later The majority of these lesions are discovered coincidentally during a routine roentgenographic examination

The pulps of teeth in the affected region are usually vital although teeth may be missing, because of injury or extraction, at the site of the cyst Fracture or extraction subsequent to the development of the cystic space will usually result in secondary infection and chronic drainage

Roentgenographic Appearance

A unilocular, radiolucent area with a well-demarcated outline is usually seen, but the condensing lamination of a true cyst is lacking Overlying cortical bone is usually thinned irregularly which gives it a false trabecular appearance Teeth are often in close proximity and may appear to project into the lumen but the lamina dura remains intact.

Diagnosis

Certain distinguishing characteristics may aid in a correct preoperative diagnosis

1 In the majority of the cases there is a history of trauma occurring approximately one year before the discovery of the cyst
2 Occurrence is predominantly in young individuals

3. The course is symptomless subsequent to trauma
4. Discovery is made during routine roentgenographic examination
5. All teeth in the involved area are vital
6. Roentgenographically there is a unilocular radiolucent bone cavity with a smooth nonsclerotic margin
7. Expansion of the mandible is rare

Treatment

Reflection of the soft tissues with a flap may disclose dark bluish tinted bone involvement overlying the cystic space. In such cases the cavity



FIG 24 26—Traumatic cyst appearing as a fairly well-delineated radiolucent zone in bicuspid interspace. Root formation of either tooth appears unaffected.

will contain fluid discolored by blood pigments. Bone staining will be absent when the lumen is empty Gentle curetment to remove soft tissue if present, will usually produce sufficient bleeding to establish a blood clot The incision should be closed tightly All tissues removed should be examined microscopically Rapid regeneration of bone and an uneventful healing usually follow

ANEURYSMAL BONE CYST

The term *aneurysmal bone cyst* describes the rather striking radiographic appearance of this lesion rather than its pathologic features The sites of involvement are usually the long bones pelvis clavicle, rib vertebra, and skull The bone has a so-called blow-out distension of part

of the contour of the affected area The term *bone cyst* in the title relates to the fact that when the lesion is surgically entered through the thin shell of the bulged area, it is found to be largely a blood-filled cavity

Etiology

While trauma is associated with a number of these lesions, it is not considered to be an initiating factor The cause remains unknown It occurs in males more often than in females, and the frequency is greatest between the ages of ten and twenty years, although it does occur in adults

Pathology

Aneurysmal bone cysts are seldom seen in the facial and cranial bones They are solitary, localized, expansile lesions which erode and destroy the overlying cortex but are delimited by a thin shell of periosteal new bone The lesional tissue is a peculiar fibrovascular structure honeycombed by smaller or larger pools of blood lying within vascular spaces The spaces lack a fibroelastic membrane Between these spaces the connective tissue is altered by foreign-body giant cells, hemosiderin-laden macrophages, and calcific deposits Coarse-fiber bone randomly scattered in the connective tissue is a prominent feature

Clinical Characteristics

Pain, aggravated by movement, palpable swelling, and slow onset were the complaints of the authors' patient with the lesion in the ramus of the mandible A history of trauma is elicited in only a few patients with this lesion.

Roentgenographic Appearance

The affected bone area, irrespective of its location, is eccentric and more or less expanded, and it not infrequently gives a periosteal blister or coarse soap-bubble-like appearance In flat bones and jaws the entire width of the affected bone area may be transformed into a roughly ovoid, expansile defect The original cortex over the ballooned-out area of the cyst is partly or completely destroyed and replaced by a thin shell of periosteal new bone This shell may be defective in places, faintly outlined, and often convoluted The appearance of the defect is relatively radiolucent, indistinctly mottled, and often trabeculated Trabeculation is not due to actual osseous septae within the lesion but results from the irregular erosion of the endosteal aspect of the cortex In the authors' case of aneurysmal bone cyst of the ramus of the mandible, the coronoid and posterior two-thirds of the ramus were involved The roentgeno

graphic appearance was not unlike that of a central giant-cell tumor and an ameloblastoma arising in a follicular cyst could not be ruled out.

Treatment

Aneurysmal bone cyst is a benign but progressive lesion Its course must be interrupted before unnecessary deformity or fracture results These cysts respond satisfactorily to simple curetment. Excessive hemor



FIG 24 27—Bone cavity appearing as a well-defined radiolucency in a characteristically nonodontic location below the mandibular canal The angulation of the film produced false evidence of a sclerotic superior margin.

rhage may occasionally be encountered but it is readily controlled by packing. Radiation therapy may also be relied on to bring a clinical cure Recurrence is not expected.

BONE CAVITIES

Bone cavities occur only in the angle of the mandible and below the mandibular canal. These spaces are rarely bilateral are not associated with any disease process and are of unknown etiology They may be the result of a congenital defect in which there is a failure of normal bone to form in the region occupied by the inferior extremity of the condylar cartilage All these lesions are first detected during routine roentgenographic examination, occur predominantly in males, and frequently remain undetected until the fifth or sixth decade

The cavities are round or oval and vary in size from 1 0 to 3 0 cm





Fig 21-28 (*Upper*)—Bone space or cavity is present in the angle of the mandible as a radiolucent unilocular area in cortical bone It lacks the sclerotic margin of a typical cyst and is not in proximity to teeth

Fig 21-29 (*Lower*)—Bone cavity causing a well-delineated, nonsclerotic, radiolucent defect below, although appearing related to the mandibular canal The relationship suggested a possible neurofibroma, although the surgical findings established a space without continuity to the canal

The majority are centrally placed, and there is a varying amount of cortical involvement. Others particularly the larger ones involve cortical bone primarily and cause an inverted U shaped defect, which is palpable along the inferior border of the mandible.

A pathologic study of these cavities reveals a nonepithelialized empty bone space, which accounts for its lack of growth

Roentgenographically the spaces are uniformly radiolucent and the margins are clear-cut with some sclerotic borders simulating an epi thelial lined cyst. The cavities are in close proximity to the mandibular canal, although its course is not distorted. The central defects are usually in contact with the periosteum, and in those located along the inferior border the periosteum invaginates to cover the superior osseous margin of the defect. Reactive new bone formation is not present.

Lesions which have been observed over periods of years without either changes or symptoms are usually not explored.

READING REFERENCES

BRADLEY J L. "Cysts of the jawbones" *J Oral Surg* 9:295–308 (1951)

JAFFE, H L. "Giant-cell reparative granuloma, traumatic bone cyst, and fibrous (fibro-osseous) dysplasia of the jawbones" *Oral Surg Oral Med. Oral Pathol* 6:159–175 (1953)

LICHTENSTEIN L. "Aneurysmal bone cyst pathological entity commonly mistaken for giant-cell tumor and occasionally for hemangioma and osteogenic sarcoma," *Cancer* 3:279–289 (1950)

OLECH, E., H SICHER, and J P WEINMANN "Traumatic mandibular bone cysts," *Oral Surg Oral Med Oral Pathol* 4:1160–1172 (1951)

ROBINSON H B G "Classification of cysts of the jaws," *Am J Orthodontics Oral Surg* (Oral Surgery Section) 31:370 (1945)

RUSHTON M A and B C CANTAB "Solitary bone cysts in the mandible," *Brit Dental J* 81:37–49 (1946)

STAFNE, E C. "Bone cavities situated near the angle of the mandible," *J Am Dental Assoc* 29:1969–1972 (1942)

WALDRON C A "Solitary (hemorrhagic) cyst of the mandible," *Oral Surg Oral Med. Oral Pathol* 7:88–95 (1954)

CHAPTER 25

Odontic Cysts

PERIODONTAL CYSTS

The terminology for periodontal cysts has varied greatly, with such names as radicular cyst, dental-root cyst, dental cyst, dentoperiosteal, dentoalveolar, and root-end cyst being applied to them. This diversification of nomenclature suggests a confusion in pathogenesis. The growths are now, however, generally known under the name of periodontal cyst, and three types are recognized: periapical, lateral, and residual. *Periapical* cysts appear at the apex of the root, *lateral* cysts are found along the sides of the root, and *residual* cysts either persist or develop after extraction of a tooth.

Incidence

The periodontal cyst is the most common pathologic formation of the jaws, exceeded in frequency only by the periodontal abscess, which often precedes it. These cysts are somewhat more common in the maxilla than in the mandible. In the maxilla a greater number are found in the incisive and cuspid regions than in the molar areas, while the mandibular cysts are three times more common in the molar and premolar regions than in anterior areas. It is of further interest to note that more than 30 per cent of the periodontal cysts in the mandible are residual, although residual cysts are somewhat less common in the maxilla. Males and females are affected equally by all types of periodontal cysts, and the age at occurrence varies from birth to eighty years, with occurrence predominantly in the fourth, fifth, and sixth decades.

Etiology

A preceding inflammation or inflammatory periapical granuloma is necessary for the development of these cysts, except possibly the lateral type. Irritation from a granuloma is thought to cause an abnormal proliferation of epithelial cells enclaved in the periodontal membrane or alveolar bone. The epithelial cells proliferate and form a covering mem-

brane around the granuloma, creating a cystic lining within bone. Liquefaction of the granuloma completes the cystification

Periapical Cysts (Periodontal) Invariably infected these cysts arise almost always from dental granulomas at the roots of nonvital teeth Since tissues in the periapical region often contain residual epithelial cells all granulomas are potential periodontal cysts

Lateral (Periodontal) Cysts These growths are very rare and it is assumed that they are sometimes of occlusal traumatic origin Occasionally an infected periapical type of cyst is seen in a lateral location in association with an accessory pulp canal although the true lateral cyst is usually sterile

Residual (Periodontal) Cysts These lesions are of periapical infectious origin and remain in the alveolus after extraction of the tooth from which they originate or rarely develop in a residual granuloma subsequent to extraction.

Histopathology

The periodontal cyst is composed of a fluid or semisolid filled cavity epithelial lining and a connective-tissue capsule.

Periapical Cyst These cysts are lined by a squamous-cell type of epithelium which resembles oral mucosa, except that there are fewer cell layers (two to five) Infection may partially or totally destroy this epithelial lining, and edema, hemorrhage and inflammatory infiltration are present in the fibrous capsule in such desquamated areas The contents of the lumen varies from a clear amber fluid to a purulent exudate and may contain, in addition, blood pigments cholesterol crystals and cellular debris.

Lateral Cyst It has the same structure as the periapical cyst but is rarely infected.

Residual Cyst This too is characteristically lined with squamous epithelium. It is located at the site of the apex of the extracted tooth. Otherwise it has the same structural components as the periapical cyst, usually with a degree of epithelial destruction and inflammatory reaction of the fibrous capsule

Bony Periapical Margin Around these cysts the bony periapical margin is made up of medullary bone of increased density which produces the characteristic linear opacity around the radiolucent cavities Where infection has caused the destruction of the epithelium and an inflammatory reaction in the periapical capsule, the increased bony density is absent. Thus this marginal sclerosis which is considered to be pathognomonic of the true cyst may be partially or totally absent in many of these periodontal cysts.

Clinical Characteristics

Symptoms are often absent, and many patients are unaware of the lesion until it is discovered in the course of a routine roentgenographic examination A toothache, tenderness, swelling, or bad taste in the mouth, usually associated with drainage, is the usual initial symptom Great



FIG 25 1 (*Left*)—Periodontal cyst with a characteristic radiolucency around the root of a lateral incisor tooth The lamina dura is absent in the apical one half, and the periodontal membrane is seen to flare out and to connect with the fibrous capsule of the cyst The epithelial lining had been destroyed

FIG 25 2 (*Right*)—Periodontal cyst arising from the right central incisor apex and secondarily involving the lateral incisor root The lamina dura has been destroyed in the apical two-thirds of both teeth, and the sclerotic margin is irregular, suggesting destruction of epithelial lining

variation is observed in the progress of these cysts Often there is little or no growth for long periods Steady enlargement with eventual spontaneous drainage may result in osteomyelitis, although rarely the process may resolve by spontaneous healing Growth, however, is usually slow, and the increase in size is dependent on the nature of the stimulus (inflammation), as well as on the texture of the bone surrounding the lesion

The cysts may involve any root in which the pulp has become nonvital The size varies greatly A few large cysts expand the cortex to



Fig 25 3 (*Upper*)—Periodontal cyst arising at the apex of the mesial root of a mandibular first molar The indefinite margin of the cyst extends forward to encompass the roots of the two bicuspids.

Fig. 25 4 (*Lower*)—Periodontal cyst at the apex of the retained roots of the first molar tooth appears as an area of decreased density with a smooth, well defined border Drainage to the distal established itself spontaneously through the alveolar crest.

parchmentlike thinness and may even produce pathologic fractures Rarely, cysts in the molar and premolar areas of the maxilla encroach upon and even perforate into the maxillary sinus

Fluid contents may spontaneously drain from these cysts, which usually contain tissue debris and, almost always, pus

Residual periodontal cysts are common and are frequently found in edentulous jaws Their symptomatology is the same, and if the process



FIG 25 5—Periodontal cyst arising from the root of a nonvital central incisor tooth with marked displacement and with a large area of destruction in the hard palate

continues, deformity of the alveolar process occurs, with displacement of dentures a frequent initial symptom

Roentgenographic Appearance

Periodontal cysts are predominantly unilocular, round or oval radiolucencies of varying sizes They are rarely of a multilocular appearance, and multiple cysts are equally rare The margins are smooth and distinct in the majority of cases, although the sclerotic border typical of most cysts may be indistinct because of inflammation The absorption of cortical bone is uniform, and the pseudoloculated appearance associated with more aggressive lesions is absent They are never associated with unerupted teeth and occur apical to or at the site of extractions of nonvital teeth The tooth roots project into the lumen, and the lamina dura is seen to be continuous with the outline of the cyst The roots of several teeth may appear to be involved, but careful study usually demonstrates



Fig 25 10 (*Upper*)—Large periodontal cyst arising from the root-canal filled first molar tooth. The cavity extends from the second molar to the cuspid region and extends inferiorly below the mandibular canal. The widening of the mandibular canal distal from the cystic cavity suggests involvement by osteomyelitis.

Fig 25 11 (*Lower*)—Periodontal cyst of a lateral type. The position of the lumen lingual to the roots of the related teeth is suggested by the continuity of the sclerotic margin superimposed on both tooth roots



FIG 25·8—Periodontal cyst arising at the apex of the lateral incisor tooth and extending from the opposite lateral area A large radiolucency is seen with a smooth, well-defined border and loss of lamina dura at the apices of the cuspid and both laterals



FIG 25 9—Periodontal cyst residual at the site of the missing first molar tooth A large radiolucent zone is seen, with a well-defined margin of increased density

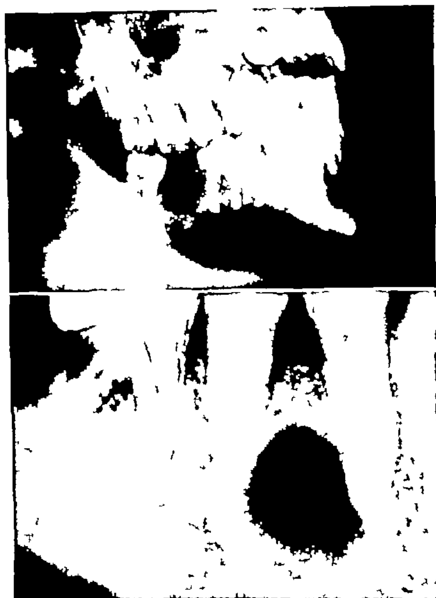


FIG 25 10 (*Upper*)—Large periodontal cyst arising from the root-canal-filled first molar tooth The cavity extends from the second molar to the cuspid region and extends inferiorly below the mandibular canal The widening of the mandibular canal distal from the cystic cavity suggests involvement by osteomyelitis

FIG 25 11 (*Lower*)—Periodontal cyst of a lateral type The position of the lumen lingual to the roots of the related teeth is suggested by the continuity of the sclerotic margin superimposed on both tooth roots

a single root as the focus Cysts, particularly, must be studied roentgenographically not only with multiple periapical views but also with occlusal and extraoral films, in order to demonstrate the essential findings Differentiation, however, between periodontal and primordial cysts in an edentulous jaw is almost impossible

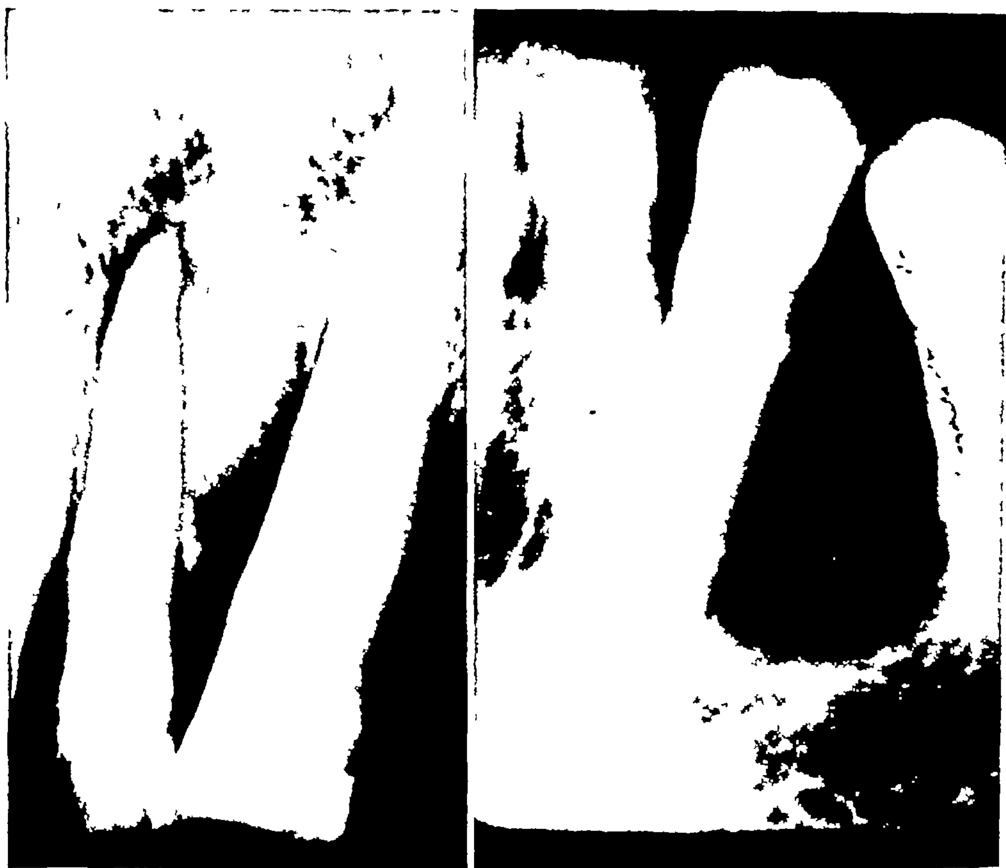


FIG 25 12 (*Left*)—Periodontal cyst simulating a lateral type, although it probably arose from the apex of the lateral incisor tooth An area of decreased density is seen between the lateral incisor and cuspid teeth, with loss of the lamina dura opposite the lesion

FIG 25 13 (*Right*)—Lateral periodontal cyst between the roots of the cuspid and bicuspid teeth An area of radiolucency is seen with a fairly well-defined inferior border and almost complete loss of interdental alveolar bone The persistence of periapical lamina dura around both roots suggests vital pulp

The lateral cysts are not necessarily associated with a pulpless tooth, and as they develop they cause a malocclusion and a separation of roots The residual type occurs at the site of a previous extraction, and the most superior portion is usually close to the alveolar crest

In the maxilla the periodontal cysts encroach upon the antrum to a varying degree and the margins are even less well defined than in the



FIG 25 14—A residual type of periodontal cyst arising at the site of extracted first molar tooth



FIG 25 15—Residual periodontal cyst with a fairly well-defined margin, except at the anterior border where osteomyelitis is seen.



FIG 25 16—Large residual periodontal cyst which has destroyed practically all cortical bone, except for a thin layer of reactive periosteal bone

FIG 25 17 (*Left*)—Periodontal cyst with an ill-defined radiolucent zone involving the apex of the lateral tooth The opacities are gutta percha forced beyond the apex into the lumen of the cyst

FIG 25 18 (*Right*)—Periodontal cyst originating from the cuspid tooth and extending from the midline to the first molar An island of bone can be seen projecting into the lumen of the cavity, and microscopic study of this bony structure demonstrated osteitis without evidence of neoplastic activity

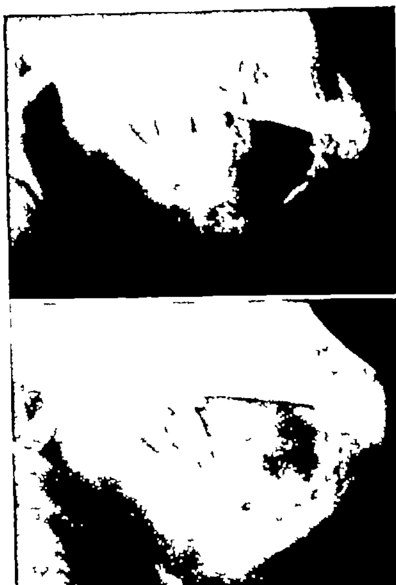


FIG 25 19 (*Upper*)—Periodontal cyst arising from roots of the bicuspid teeth The margins are irregular because of low-grade osteomyelitis

FIG. 25 20 (*Lower*)—Same case as in Fig 25 19 two years after extraction, drainage and light curettage. New bone is filling in the defect. (*Courtesy of Paul H Hamilton, D D.S*)

mandible Contrast media should be used to outline the margins and identify relations with the maxillary sinus

Treatment

Complete enucleation of the epithelial lining is indicated for most cysts of the jaws An evaluation, preoperative, of the general health of the patient must be made, and consideration must be given to any local complication, such as inflammation, osteomyelitis, or possible pathologic fracture Drainage may be required until the inflammation has subsided When pathologic fracture is an additional complication, it is advantageous, before enucleation, to permit at least a fibrous union to develop while continuous drainage is maintained.

The actual enucleation of the cystic membrane is not difficult, but every effort should be made to preserve vital teeth and the function of the mouth The enucleated cyst membrane should always be examined histologically Cysts which, by their expansion, have destroyed a considerable amount of bone and encroach on healthy teeth to the extent that their lamina dura is continuous with the fibrous tissues of the sac should be reduced in size by continuous drainage before an attempt is made to remove the epithelial lining either partially or completely. When a drainage procedure succeeds in a complete reduction of inflammatory reaction, a marsupialization procedure may be advantageous in certain locations However, complete enucleation is often most desirable, and the cavity heals well with organization of a primary clot In the large cavities, a packing is often necessary until the bony walls are covered by healthy granulation tissue

Prognosis

The prognosis is good after conservative surgery.

FOLLICULAR CYSTS

Any of the cellular elements of the tooth germ of the dental follicle may be enclaved, proliferate sooner or later, and give rise to tumors and cysts Follicular cysts are of such odontic origin Before differentiation of the tooth germ into a tooth-producing organ, a *primordial*, or simple, follicular cyst may develop At a later stage in development, after differentiation but before the eruption of a tooth, the *dentigerous* type of follicular cyst may arise Rarely, either type may be further complicated with the development of an ameloblastoma In either case, the development of the tooth is prevented or arrested by the cystic process Thus, in the primordial type, a tooth will invariably be missing from the dental

arch, unless the cyst arises in association with a supernumerary tooth germ. In the dentigerous type the involved tooth may be demonstrated roentgenographically but seldom erupts Differentiation of these odontic cysts from all other cysts and cystic appearing tumors is of paramount importance for proper treatment and prognosis, since the epithelial lining of these lesions is more prone to ameloblastic or carcinomatous change than is that of other cysts.

Incidence

Follicular cysts are less common than the periodontal type in a ratio of 1 5- and the primordial cyst is less common than the dentigerous variety in a ratio of 1 2. The sexes are affected equally The age incidence (time of detection) for primordial cysts is about the same as for periodontal cysts ranging from infancy to seventy five years with a preponderant but equal number appearing in the third fourth, fifth, and sixth decades

Etiology

Many theories concerning the origin of follicular cysts have been proposed and the present concepts are that they may develop either from the enamel organ in an early stage, or from residual epithelial remnants

Primordial These cysts arise before the mesenchymal papilla has formed pulp or dentin, and the cystic process also inhibits the differentiation of the potential enamel forming epithelium. Rarely primordial cysts may arise from supernumerary tooth buds

Dentigerous This type of follicular cyst is formed within the permanent or supernumerary tooth. Rarely a deciduous tooth is involved. All such cysts arise prior to eruption of the tooth. The actual cause which incites this process is not definitely known, although since they are invariably associated with unerupted teeth, factors which delay the dentition such as minor trauma, nutritional deficiencies, hormonal imbalances and febrile diseases have all been suggested

Histopathology

Follicular cysts are fluid filled, epithelial lined bone cavities with a surrounding dense fibrous capsule. The lining is most commonly a stratified squamous-cell type, although rarely it may be cuboidal The epithelium may vary from a few to many cell layers and frequently papillary formations are observed It is ordinarily not possible from the microscopic study alone to distinguish between the various cysts of the jaws The epithelium is separated from bone by a dense fibrous connective tissue sac which is made up of collagen fibers arranged parallel to the periphery

Grossly, the characteristic pericoronal position and cervical attachment of the epithelial lining are often demonstrated, but microscopically, demonstration of this attachment is complicated by the fixation and decalcification method.

All follicular cysts contain fluid and the dentigerous type contains, in addition, the crown of the tooth The fluid may be clear or straw



FIG 25 21—Primordial type of follicular cyst with minimal bone destruction The follicle of the missing cuspid is the probable origin

colored, although occasionally either type may be secondarily infected, with pus present in the fluid The fluid contains desquamated epithelial cells and, commonly, cholesterol crystals The cystic sac should always be examined microscopically, because either ameloblastoma or carcinoma may complicate these cysts

Clinical Characteristics

Both varieties of the follicular cyst affect jaws equally, but the single most common site for either type is along the developmental route of the mandibular third molar tooth Many of the primordial cysts arise in



FIG 25 22 (*Upper*)—Primordial type of follicular cyst which arose in the follicle of the missing bicuspid tooth The large radiolucency is fairly well defined and has displaced several roots of teeth. The anterior teeth are tipped mesially while the bicuspid is displaced buccally

FIG 25 23 (*Lower*)—Dentigerous type of follicular cyst involving the permanent second bicuspid and first molar teeth. The cyst extends posteriorly to involve the mesial root of the first molar tooth.

the ramus, even as high as the coronoid process, and develop without affecting the function of the more anterior teeth In the maxilla the cuspid is the most common unerupted tooth while the lateral incisors and the third molars are the most common undeveloped teeth

Great variation is observed in the size of follicular cysts from relatively small intraalveolar cavities to tremendous expansile bone spaces which replace the medullary cavity and erode the cortical bone to a thin shell



FIG 25 24–Dentigerous type of follicular cyst involving the unerupted maxillary permanent cuspid

Primordial Such cysts are usually asymptomatic for years particularly in the mandibular third molar area and ramus When they arise in more anterior positions there is a greater tendency to displace the roots of adjacent teeth and produce malocclusion When other early symptoms occur, such as pain paresthesia, or tenderness, they are usually due to expansile pressure on nerve trunks or periosteum The cyst, at later stages may become secondarily infected or pathologic fracture may occur However, in the absence of early subjective symptoms, a tooth missing from the dental arch or expansion of cortical bone are the most suggestive signs of cyst formation

Dentigerous These cysts are asymptomatic for a long period of time Frequently the only objective sign is the missing tooth but this sign is not constant since these cysts may develop from a supernumerary tooth or, rarely, from a deciduous tooth Characteristically, however, they are



FIG 25 25 (*Upper*)—Dentigerous type of follicular cyst associated with and displacing the crown of the upper third molar tooth

FIG 25 26 (*Lower*)—Dentigerous type of follicular cyst arising from the em bedded permanent right cuspid tooth



FIG 25 27 (*Upper*)—Dentigerous type of follicular cyst arising in the follicle of the third molar tooth

FIG 25 28 (*Lower*)—Dentigerous type of follicular cyst which involves the angle and almost all of the ramus



FIG. 25 29 (*Upper*)—Dentigerous type of follicular cyst, arising in the follicle of the third molar tooth, appears to involve the apices of both first and second molar teeth

FIG. 25 30 (*Lower*)—Same case as in Fig. 25 29 Apical involvement confined to the second molar tooth is demonstrated



FIG. 25-31 (*Upper*)—Dentigerous type of follicular cyst arising in an unerupted third-molar-tooth follicle, with the crown and remaining part of the root within the lateral wall of the cyst. Note the unerupted contralateral third molar in an otherwise edentulous jaw.

FIG. 25-32 (*Lower*)—Large dentigerous type of follicular cyst arising from an unerupted second bicuspid tooth which is lying within its wall. The cyst is encroaching upon the cuspid, first bicuspid, and first molar teeth.





FIG. 25 33 (*Upper*)—Dentigerous type of follicular cyst arising from an un erupted third molar tooth It has destroyed the greater part of the angle and ramus of the mandible, as well as displaced the molar in an antero-inferior direction.

FIG 25 34 (*Lower*)—Dentigerous type of follicular cyst arising from the un erupted second bicuspid tooth. The cuspid and the first and bicuspid teeth have been displaced downward and forward.

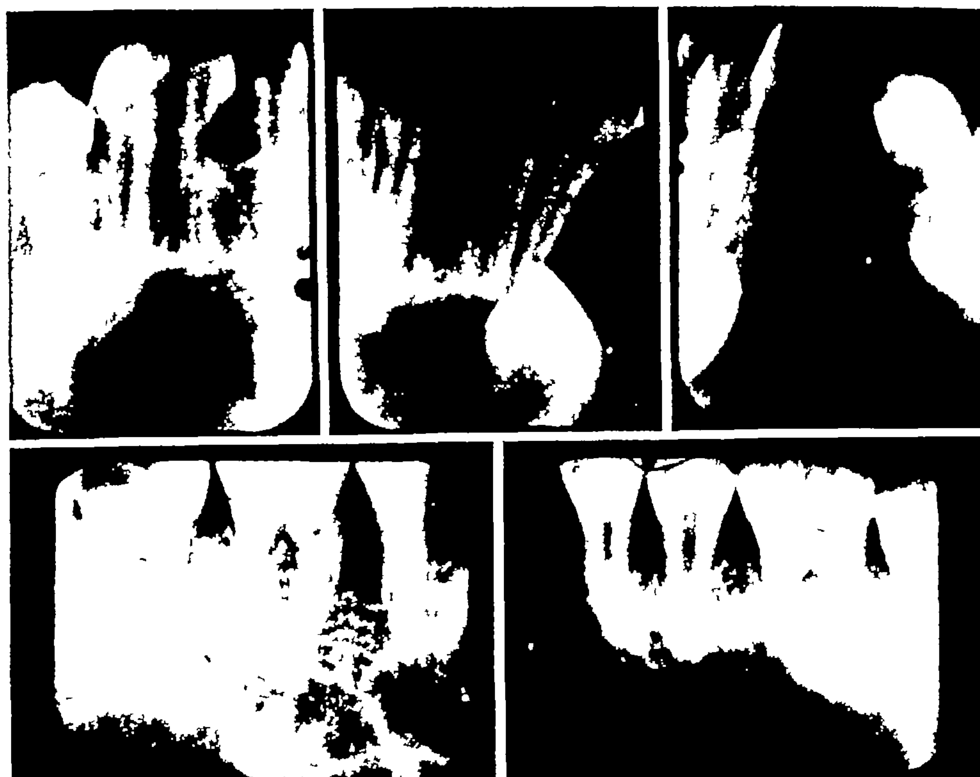


FIG 25 35—Dentigerous type of follicular cyst arising from the unerupted cuspid tooth The varied radiolucency is due to the irregular absorption of cortical bone



FIG 25 36—Dentigerous type of follicular cyst arising from the third molar The cyst has caused marked destruction and expansion of the body, angle, and ramus of the mandible

often associated with an unerupted permanent tooth and most nonly with the mandibular third molar

rly symptoms are rare but when present they include aching or erness in the jaw local or referred pain swelling and even facial metry When the expansile process is primarily toward the lingual, acement of teeth may be the earliest sign of involvement while



25 37—Dentigerous type of follicular cyst arising from the permanent cus tooth. The right deciduous cuspid is still in occlusion, while the involved id has been displaced downward to the inferior border of the mandible

ral expansion of cortical bone may be the earliest sign in the buccal tions When these cysts arise from impacted, unerupted teeth, com lication of the cystic cavity with the oral cavity may be established ugh a deep paradental involvement of the adjacent erupted teeth, inflammation with or without drainage may occur

Without surgical intervention the cortical bone eventually becomes pletely destroyed pressure on palpation may cause crepitus and idental minor traumas may produce pathologic fracture.

meloblastoma is frequently observed as a complicating formation the lining epithelium of either primordial or dentigerous cysts while cinomatous changes are rare

Roentgenographic Appearance

Follicular cysts appear as areas of decreased density of varying sizes, with smooth well-defined margins The degree of radiolucency is dependent directly upon the amount of cortical bone destroyed, but a light



FIG 25 38—Dentigerous type of follicular cyst arising from the third molar tooth The lesion has produced a large expansile radiolucent area which has involved the posterior half of the body and ramus of the mandible

line of increased density defining the margin usually accentuates this decreased density Roentgenographically, the two types, primordial or dentigerous, may be easily distinguished from each other

Primordial These cysts are most often located in the ramus or angle and usually attain considerable size before recognition Because of their posterior position, full roentgenograms may fail to demonstrate the pathologic process Often those in the ramus are more commonly unilocular, while those at the angle are multilocular The latter type produces



Fig 25 39 (*Upper*)—Dentigerous type of follicular cyst arising from the in verted cuspid tooth. The lesion has involved the entire body of the left man dible

Fig. 25 40 (*Lower*)—Same case as in Fig 25 39 with multiple cysts in the right half of the mandible A primordial follicular cyst involves the first bi cuspid, and a dentigerous type of follicular cyst with probable origin from the follicle of the missing first molar arises in the third molar tooth The contra lateral cuspid involvement is seen in the anterior region.

a roentgenographic appearance of a compartmentlike pattern, usually larger and of more uniform size than the honeycomb type of formation seen in ameloblastoma. This is actually a false appearance, since the cystic cavity is a single space. Less frequently, more complicated formations, which are multiple cysts, are seen. Differentiation can be made with use of contrast-media techniques.

The features distinguishing a primordial cyst from others are the lack



FIG. 25-41—Dentigerous type of follicular cyst arising from the cuspid region, and a primordial type involving the angle and molar regions.

of calcific structures within and the usual well-defined cortical margin.

Dentigerous. These cysts characteristically contain calcified elements—the coronal portion or entire tooth, which may be a permanent, deciduous, or rudimentary tooth. A portion of the unerupted tooth may be shown, roentgenographically, to be within the cystic cavity. The direction and degree of displacement of the tooth from its normal course, and the extent of distortion of the roots, are dependent upon the positional relation of the cyst to the tooth and upon the stage of development of the tooth at the time the cyst formed.

Follicular cysts vary greatly in size and extent, and from their most common location they tend to extend into the ramus to form large unilocular cavities. Frequently a cyst extends forward to surround one or more roots of adjacent normal teeth, but it seldom causes root absorption and only rarely causes displacement of such teeth. In the maxilla, lesions encroach upon or replace the maxillary sinus and an opaque

media may be required to outline its margins. The osseous margin is usually smooth and well defined by a dense cortical peripheral zone Multiple cysts of the follicular type are occasionally seen They may be of either type—primordial or dentigerous—alone or in combination



FIG 25 42—Same case as in Fig 25 41 showing multiple follicular cysts which have destroyed the entire body and inferior one-half of the ramus Evidence of fracture is seen in the third molar area

Diagnosis

The follicular cyst presents a diagnostic problem particularly in its multilocular form, when it must be distinguished from neoplastic processes such as an ameloblastoma or giant-cell tumor as well as from the giant-cell reparative granulomas

The primordial cyst contains no calcified structures and is most often located in the third molar region near the angle of the mandible As it invariably develops from the dental follicle of a permanent deciduous or supernumerary tooth, developmental absence of a tooth from the dental arch is a common associated finding In the edentulous jaw it is not distinguishable, roentgenographically from a residual type periodontal cyst

The dentigerous cyst is always related to an unerupted permanent,

deciduous, or supernumerary tooth, the crown of which is usually located within the cystic cavity but is found occasionally in contiguous tissues This cyst always contains, or is in close association with, identifiable calcified elements which may be distinguished, roentgenographically, as normal unerupted teeth, small rudimentary supernumerary teeth, or occasionally odontomas

Good roentgenographic technique is essential, and multiple projections



FIG 25 43—Dentigerous type of follicular cyst with a large radiolucent area in the molar region, which has a fine trabeculation or honeycomb pattern through part of it, suggesting a complicating neoplastic process which was proved to be an ameloblastoma

from various angles are indicated to show all the cystic walls In this manner it is possible to distinguish between both types of follicular cysts and other odontic and nonodontic cysts This technique is necessary in order to evaluate the possibilities of an ameloblastoma, which often develops in the walls of cysts, and it is helpful in distinguishing follicular cysts from all central soft-tissue tumors However, final diagnosis cannot be established prior to microscopic study of the cystic lining

Treatment

A surgical approach is required The technique may vary with location, size, and inflammatory state of the cyst Careful planning of the surgical procedure is necessary to preserve the vitality of the teeth

Small Infected Cyst This type of lesion usually does not have an epithelial lining A surgical-flap approach will permit adequate access for



Fig 25 44 (*Upper*)—Dentigerous type of follicular cyst arising from the third molar tooth which is embedded in the large cystic process

Fig 25 45 (*Lower*)—Same case as in Fig 25 44 one year following the exposure and removal of the tooth and lining membrane New bone has almost completely obliterated the defect (*Courtesy of John B Wilson D.D.S*)

curetment of the fibrous capsule, and healing by organization of blood clot can be obtained Adequate antibiotic therapy is indicated

Small Noninfected Cyst This growth requires the removal of the unerupted tooth and of the entire epithelial and connective-tissue lining Usually, primary closure of the tissue flaps can be obtained, although marsupialization is useful in some cases

Large Cysts These cysts require sufficient surgical exposure to permit complete removal of the epithelial lining This complete enucleation is a relatively simple procedure when the site and the amount of exposure are well planned The surgical approach for mandibular cysts may be intraoral or occasionally extraoral The flap is usually developed anteriorly to the area of greatest cortical thinning, and access to the cystic cavity is obtained at this thinnest portion Disturbance of the structures in the mandibular canal should be avoided When the entire lining can be removed, a primary closure is possible When it cannot be entirely removed, because of angulation, etc , marsupialization will permit gradual filling of the cavity The extraoral approach may be selected in certain cases when it is advantageous to pack large cystic cavities with bone chips In the maxilla the approach is usually through the buccal aspect of the alveolar ridge When unerupted cuspids are involved, the palatal approach is used The enucleation of the epithelium is the same as for a mandibular cyst, and the membranes should always be examined histologically

Periodic Follow-up Roentgenographic Examinations Such examinations are required to observe bone regeneration and to rule out the possibility of neoplastic activity

READING REFERENCES

BERNICK, S "Dentigerous cysts of the jaws," *Oral Surg Oral Med Oral Pathol* 2 914–921 (1949)

DARLINGTON, C G , H E EHRLICH, and H M SELDIN "Malignant transformation of odontogenic cyst," *J Oral Surg* 11.64 (1953)

STAFNE, E C , and J A MILLHON "Periodontal cysts," *J Oral Surg* 3 102 (1945)

THOMA, K H "Diagnosis and treatment of odontogenic and fissural cysts," *Oral Surg Oral Med Oral Pathol* 3 961–986 (1950).

Index

Page numbers in *italic* refer to illustrations.